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No. 121

Energy: Conservation Efforts Taking Hold, New Avenues Explored

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ENERGY: CONSERVATION EFFORTS TAKING HOLD, NEW AVENUES EXPLORED

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TRADITIONAL ENERGY SOURCES:

CURRENT DEVELOPMENT TRENDS TO CONTINUE THROUGH YEAR 2000

THERMAL, HYDROPOWER GENERATION TO BE TACKLED SIMULTANEOUSLY

Hong Kong CHING-CHI TAO-PAO [ECONOMIC REPORTER] No 30, 30 Jul 80 pp 4-6

[Interview with Li Daigeng [2621 0108 5087], deputy minister of the Ministry of Electric Power Industry. "The Deputy Minister of the Ministry of Electric Power Industry Li Daigeng Answers the Questions"]

[Text] In order to realize its four modernizations, China must aggressively develop its energy resource industry. The electric power industry, which is one of the important energy resources, is at the center of the general concern of the public today.

[Question] What is the present state of the electric power industry in China?

[Answer] The total electric power generation in China reached 281.95 billion kilowatt hours last year, occupying seventh place in the world. The total electric power generation over the first half of this year was 147.39 billion kilowatt hours, an increase of nine percent compared with the same period last year.

This huge accomplishment was brought about by the effort and struggle of the vast majority of the staff and workers of the ministry of electric power industry over the past 30 years, building up from an extremely backward foundation of the old China era. The total electric power generation in 1979 was 65 times of that in 1949 and the equipment capacity today is 31 times of that in 1949. The distribution of the electric power industry in China has also seen a significant change. Today, the powerful electric power industry is no longer the monopoly of those coastal areas such as Dongbei, Huadong, Beijing, and Tianjin. Many large to medium scale electric power plants have been built in such areas as Zhongnan, Xinan, and Xibei; even in the faraway frontiers and the mountainous areas. According to the statistics compiled before the end of last year, there are more than 2,847 electric power plants with greater than 500 kilowatt capacity, of which, 1,528 are hydropower plants and 1,319, thermal power plants. Among these, there are 69 large-scale power plants with the equipment capacity in excess of 250 megawatts (MW), amounting to more than one-half of the total equipment capacity nationwide. Among the large-scale thermal power plants are the Qinghe plant in Liaoning, the Wangting plant in Jiangsu, the Tangshan plant in Hebei, the Shijingshan plant in Beijing, and the Qingshan plant in Hubei. Among the large-scale hydropower plants are the Liujiaxia plant in Gansu, the Danjiang plant in Hubei, the Gongzhui plant in Sichuan, the Xinanjiang plant in Zhejiang, and the Tuoxishui plant in Hunan. These hydropower plants are distributed on a number of rivers including the Huanghe, the

Hanjiang, the Daduhe, the Xinanjiang, and the Zishui. In addition to these, there are thousands and tens of thousands of small-scale hydropower plants scattered all over the country from south to north in the vast majority of villages and mountainous areas. In praise of these hydropower plants, people refer to them as 'brilliant pearls scattered along the rivers of our fatherland.'

[Question] Please talk about the development of the electric power network in China.

[Answer] China's electric power network is steadily expanding with the growth in number of thermal and hydropower plants and the areas served by these plants. At present, there are already 20 electric power networks with more than 500 MW capacity nationwide. Of these, 12 networks have an equipment capacity in excess of 1,000 MW. These networks include the Jing-Jin network, the Eastern China network, the Northeast network, the Shaan-Gan-Qing network, the Central China network, the Shangdong network, the Shanxi network, the Sichuan network, the Guangdong network, the Xiangzhongbei network, the Southern Hebei network, and the Guiyang network. Within each network, the hydropower and thermal power plants complement one another and by making timely adjustment they insure a safe and steady power generation and distribution in order to satisfy demands of industrial and agricultural production as well as the people's daily lives.

In order to strengthen further the centralized and unified administration of the electric power networks, three more offices have been opened in North China, the Northwest, and Central China recently in addition to the two existing electric power industry administrative offices in Northeastern and Eastern China. Since January of this year, the North China and the Northwest electric power industries' administrative offices have begun unified management of the electric power generation of the North China and the Northwest areas, respectively. In order to facilitate the expansion of electric power network and to fully exploit the energy resources of the Southwest area, the Southwest area electric power industry administrative office is under planning now.

[Question] What electric power construction projects have been carried out in China recently?

[Answer] Last year alone, 41 large to medium-scale hydro- and thermal power plants were built by the electric power industry in this country, and 53 generating units were installed with a total capacity of 4,150,000 kilowatts surpassing the national electric power construction plan.

Some of the thermal power plants and the thermoelectric generating units put into operation recently are large-scale mining area power stations built right next to coal mines, such as the Shuzhou plant in Jiangsu, the Jiaozuo plant in Henan, the Matou plant in Hebei, the Shentou plant in Shanxi, the Hancheng plant in Shaanxi, and the Shilicuan plant in Shandong. The Shuzhou electric power plant which was built in the vicinity of the Shuzhou Mining Bureau completed assembly of its four generator units, each rated at 125,000 kilowatts, in December of last year and is today delivering 7 million kilowatt hours of electric power into the Huadong electric power network everyday. This has helped significantly to the relaxation of the electric power shortages in the Jiangsu and Huadong areas.

The hydropower stations newly built and the hydro-electric generating units put into operation recently include the Wujiangdu plant and the Maotiaohe fifth-class plant in Guizhou, the Hunanzhen plant in Zhejiang, the Taipingxiao plant in Liaoning, the Xierhe first-class plant in Yunnan, the Huaan plant in Fujian, and the Niululing plant in Hainan Island.

The Wujiangdu hydropower plant in Guizhou is located at a natural barrier where the Red Army once forded the Wujiang forcefully. The total design capacity of the generating units is 630 MW and its dam is 368 meters long and 165 meters high. This is the largest dam ever built so far as part of the construction project of a hydropower plant in this country. The No 1 hydroturbine electric power generator of this plant with a capacity of 210 MW has already started delivering electric power in the network.

[Question] How is the construction project of the Gezhouba plant--the largest hydropower plant in this country--progressing?

[Answer] The Gezhouba construction project--the first large scale hydropower station to be build on the 10,000 li long Changjiang of this country--is being carried out aggressively. The construction site is situated within the boundary of Yichang City in Hubei Province 2.3 kilometers downstream of Nanjinguan at the mouth of the Xilin gorge among the three gorges of the Changjiang. After Nanjinguan, the flow of Changjiang changes from eastward to southward and the river valley widens suddenly from 300 to 2,300 meters and the flow slows down. The two islets--Gezhouba and Xiba--divide Changjiang into three streams: Dajiang, Erjiang, and Sanjiang. The Gezhouba project is situated right there across the Changjiang.

The Gezhouba hydropower station has a total capacity of 2,715 MW and is capable of generating 13.9 billion units of electric power each year. When this construction project is finished, it will be able to relax the electric power shortage of the Zhongnan area significantly.

The Gezhouba project is divided into two stages. The first stage involves construction of 2 ship locks and 6 sand-washing channels on the Sanjiang, and a power plant building to house 7 generating units with a total capacity of 50 MW and a 27-channel sluice gate on the Erjiang. The dirt and rock that must be dug up and replaced afterward reach a total of 70 million cubic meters, and 5.73 million cubic meters of concrete must be poured. 80 percent of the construction work of this stage was finished last year. For example, construction of the lock dam approaches the design height; construction work related to the No 2 and No 3 ship locks and the 6 sand-washing channels is basically finished; the dam at the entrance section to the power plant has been raised to the height of 68 meters; the No 1 generator foundation ring is being installed now; and 19 of the 27 sluice gates have been installed.

This project is undertaken by the 330 Engineering Bureau. In the 3 years since the "gang of four" was smashed, the speed of construction has significantly increased, and the construction work surpassing the planned amount has been accomplished year after year. The entire staff and the workers are united in their effort. They are striving, under the premise of assuring engineering quality, to finish the project this year and to realize the damming of a mighty river. They want to restore navigation to the river and to begin generating electric power in 1981.

[Question] How is the progress of construction project related to the Longyangxia hydropower plant on the main course of the Huanghe?

[Answer] The Longyangxia hydropower plant with a total generating capacity of 1,500 MW capable of delivering 6 billion kilowatt hours of electric power which is under construction on the upper main stream of the Huanghe is yet another large-scale hydropower plant after the Jilinjiaxia plant, the Yangguoxia plant, the Qingtongxia plant, and the Bapanxia plant.

The plant site is situated at the Longyangxia within the Guonghe County, Qinghai Province, at an elevation of 2,600 meters above sea level. After flowing past the prairie of Qinghai Province, the Huanghe enters a gorge 40 kilometers long and only 30 meters wide. The average flow rate measured over many years has been found to be as much as 640 cubic meters per second, truly a rich hydropower resource with relatively small sand content. The Longyangxia hydropower plant is going to be the "dragon head" of a series of more than 10 ladder hydropower stations built along the upper reach of the Huanghe. Its dam will be 172 meters high with a reservoir capacity of 24.7 billion cubic meters. Once this reservoir is filled and begins to regulate the flow, it will be able to significantly increase the guaranteed output of each station at each step along the river downstream and also increase the effectiveness of irrigation and flood control. After the construction of this station is completed, the electric power generated by this plant will be distributed to the two industrial cities of Xining and Lanzhou, and also reach areas covered by the Xibei electric power grid. It will contribute much to the construction of four modernizations in the Northwestern area.

The construction project of this hydropower station is being undertaken by the Fourth Engineering Bureau of the Ministry of Electric Power Industry. The preparation began in 1976, and the entire staff and the workers fought bitter battles overcoming the difficulties in the sparsely populated prairie of Qinghai, where the air is thin, the weather bitterly cold, and the winds blow sand into the sky, and basically finished the preparatory and supplementary engineering work. Construction of a penstock, 16 meters wide, 15 meters high, and 661 meters long, was completed in November last year. On 29 December, the flow of the Huanghe was successfully blocked and the construction project of the entire power station has now entered into the most crucial stage. At the mouth of once sparsely populated Longyangxia, a new industrial city with a population of more than 20,000 is gradually shaping up and more than 300,000 square meters of buildings for production as well as living have been built.

[Question] Please tell us about the two newly built 500,000-volt high tension transmission lines.

[Answer] In October last year, we began the construction of the first 500,000-volt high tension transmission line of this country--the Ping-Wu transmission line. This line links the Pingdingshan coal base in Zhongyuan with the industrial city of Wuhan in Hubei Province. The line cuts across the plains of southwestern Honan and northern Hubei, and spans the Shahe, the Baihe, the Hanhe, and the Changjiang, with a total length of 610 kilometers.

The purpose of constructing this transmission line is to raise the safety and stability of the Central China power grid and to assure the electric power supply to the 1.7-meter rolling mill of the Wuhan Steel Co. A portion of the equipment used in the construction of this transmission line will be imported from France, Switzerland, and Japan. So far, approximately 60 percent of the concrete foundations for the steel towers and 10 percent of the steel towers have been constructed, and the area for the construction of three 500,000-volt transformer stations has been leveled and readied.

Another 500,000-volt high tension transmission line which is under construction simultaneously is to transmit electric power generated at the Yuanbao coal base in Liaoning Province to the Liaoyang industrial base. The total length of this line is 380 kilometers. All equipment needed for the construction of this line will be manufactured domestically.

The highest voltage of the high tension power transmission lines constructed in this country so far is 330,000 volts. The two 500,000-volt transmission lines under construction today are the highest voltage power transmission lines constructed since the birth of New China.

[Question] What are some of the new technical achievements of the electric power industry?

[Answer] The electric power industry has achieved many technical innovations in fields such as production, construction, design, processing, building enterprises and the specialized research institutes belonging to them. The electric power industry is pushed forward by these achievements. Since the National Science Conference was held, there have been 820 technical achievements reported. In addition to the three national invention awards which went to the preparation and the working technology of an epoxy-emergy coating layer as a sand and mud wear resistant layer applied to hydropower machinery, the preparation and the working technology of a complex nylon layer as a sand and mud wear resistant layer to be applied to hydropower machinery, and a hydraulic linking and locking device for the Model TTW-400 pressure regulating valve used in hydropower stations, 16 important scientific achievements were recognized early last year by the Ministry of Electric Power Industry after careful review. For example, according to regulations, the impact load electric power supply to the 1.7-meter rolling mill of the Wuhan Steel Co. under the impact load condition should not alter its frequency more than ± 0.5 Hertz and its voltage more than ± 5 percent. Through repeated test with models, a high speed spark tracking regulating system was developed, and an improved and more reliable power supply technical plan was drafted, then load test was carried out. Under a rotational capacity of 3,460 MW, this roller was operated to carry out both cold and hot rolling operation, and the tracking regulating device was also inserted into the system. It was found that when the impact load was 90 MW, the network frequency drop was only 0.17-0.2 Hertz and the maximum voltage variation was less than 2.5 percent. The actual operational results revealed that the theory provided by the results of this scientific research and the high-speed monitoring and regulating device constructed according to this theory have successfully solved a key production problem. As a result of research and development, the Jing-Jin-Tang electric power grid adopted a safety surveillance and information display system, which enabled the 40 generating and transformer stations handling 99.4 percent of the total grid capacity to transmit information of a digital nature. They have thus realized remote measurement and remote inquiry. The operational conditions of the 14 220-kilovolt transformer stations as well as their flow distribution and the switch positions can all be displayed simultaneously on the 26 T.V. screens from which the personnel on duty can obtain information in time to make correct judgement and issue directions. Since this equipment has entered service, accidents have been effectively prevented and losses due to failure have been significantly reduced.

[Question] What about small-scale hydropower development in our rural villages?

[Answer] As the demand for more electric power grew with the development and reform of agricultural techniques, counties, communes, and production brigades, with the support of the government, undertook construction of small hydroelectric power stations to satisfy locally the need for electricity in the villages. By late last year, there were more than 90,000 small hydroelectric power stations throughout the country with a total generating capacity in excess of 6,000 MW.

The development of small hydroelectric enterprises in this country since Liberation has had two stages. Before 1957, a small number of southern provinces emphasized construction of a few hydroelectric power stations. After the collectivization of agriculture, small-scale hydropower stations grew rapidly in number with the development of collective economy. In recent years, more than 600 MW have been added each year. We have carefully guided the vast majority of the farmers in their eagerness to develop their electric power generating enterprises so that their undertakings have been coordinated with the construction of the electric power grids in order to avoid wastefulness in manpower as well as material and to achieve the greatest effect.

Today, 86 percent of the peoples' communes and 62 percent of the production brigades throughout the country have electricity available to them. Rural electric power is supplied mainly by the large electric power grids, and the small hydroelectric power stations are only supplementary to these large grids.

Our country is so large in size that there are still nearly 40 percent of production brigades where electricity cannot be supplied by the large power grids. Some of these areas are rich in hydropower resources, especially in mountainous areas far from the big to medium metropolitan areas. Assisted by the government, counties, communes and brigades are using their own manpower and local hydropower resources to construct small hydroelectric power stations in order to make electricity available to the villages as soon as possible. This will not only liberate a large amount of the rural labor force but also accelerate technical reforms in the villages. This year we must continue to make unified planning, make overall arrangement, select areas with favorable conditions for development and encourage the further development of the small-scale hydropower industry. At the same time, we must strengthen the management of these small hydropower stations in order to raise their technical standards and increase their impact.

[Question] How many kinds of new energy resources have we begun to tap for electric power generation?

[Answer] Those which we have already begun to exploit include wind power, geothermal energy, methane gas, and tidal power.

Along the coast, on the prairies, on the plateaus, and in some mountaineous areas of China, the wind power resource is quite abundant. According to the distribution of wind power resources in China and the state of the technology today, our effort in recent years has been concentrated on small-scale wind power generators which are relatively more reliable, simple to construct and less expensive. We are still in the research stage. The largest experimental unit, with a capacity of 18 kilowatts, has been built on Sijiao Island, Zhejiang Province. It has been in operation for more than 3,000 hours. In the Inner Mongolia Autonomous Region, more than 200 small wind power generators with a capacity in the range of 100-250 kilowatts have been built to supply electricity for the purpose of illuminating the Mongolian "bao," projecting movies, and electrifying corral fences.

There are as many as 2,400 natural hot springs having a temperature of 100 °C or less distributed throughout China which have been confirmed. To utilize the geothermal energy available at temperatures below 100 °C, we have constructed 6 experimental stations, of which the Feitang station (300 kilowatts) in Ningxiang Country, Hunan Province has been found to operate most smoothly. It has achieved continuous, safe, full-load power generation, and its waste heat is further utilized in such areas as medical treatment, agricultural research, and the peoples' daily hot water usage. As to the high temperature wet steam thermal fields which have been confirmed, we have the Yangbajing geothermal field situated 90 kilometers northwest of Lhasa in the Tibet Autonomous Region. It has been confirmed that wet steam at a temperature of 150 °C or so can be obtained from a geological structure at a depth of 500 meters. The highest temperature in the well is 172 °C. An experimental station with 1 MW capacity was built in October 1977. Two more units with a capacity of 3 MW each are under construction now. The first unit will be ready for test runs during the fourth quarter of this year.

Methane gas is generated when organic matter is decomposed by the action of microorganisms. It can be used not only for cooking, illuminating, and making fertilizer, but also as a cheap energy resource in rural villages. There are altogether 715 methane gas power stations that have already been built (with a total of 923,000 horsepower) and there are 617 methane gas electric power stations (with a total generating capacity of 5,069 kilowatts). According to the experience of the production brigades, 8-12 kilowatt generator units are most popular in the brigades for supplying electricity for illumination and food processing. We have built two experimental stations with 8 and 12 kilowatt capacity each. After these generators are authenticated, we plan to popularize these units among the brigades.

Research work on tidal power generation in this country was initiated in 1958. Those stations which have begun generating power so far include the Rushan station (300 kilowatts) and the Jingang station (165 kilowatts) in Shandong Province; the Xiaosashan station (200 kilowatts), the Xiangshan station (100 kilowatts), and the Wenling station (500 kilowatts) in Zhejiang Province. Since these stations were built and entered into production, they have positively supported the local agricultural and fishing production.

[Question] Finally, please talk about the development plan of our electric power industry.

[Answer] This country suffered a severe shortage of electricity for more than 10 years thanks to the interference and destruction wrought by Lin Biao and the "gang of four." The shortage of electricity has become one of the outstanding contradictions of our national economy. In order to solve this contradiction, the Party Central Committee indicated clearly in 1977 the need for an accelerated construction of the electric power industry in order to grasp electricity with an extraordinary effort. When the Eight Character guidelines concerning reorganization of the national economy were published by the Party Central Committee in 1979, the need for reorganization of the proportional relationship between the power industry and other industries was reiterated. We believe that in developing power industry in this country we must take into consideration our energy resources and develop both thermal and hydropower generation simultaneously. We must develop both hydropower and thermal power generation according to what the local circumstances dictate.

The hydropower resource of this country is quite abundant. There is a confirmed reserve amounting to 677 million kilowatts with an exploitable capacity of as much as 378 million kilowatts. We consider that in the next decade or two, the key points for the development of hydropower include some 10 large-scale hydropower bases on and along the upper reaches of the Zhujiang, the upper reaches of the Huanghe, the upper reaches of the Changjiang, and the Yalongjiang. The large- and medium-scale construction projects which are being carried out this year in these hydropower bases with a total capacity of 9,200 MW include, for example, the Lubuge plant (600 MW) and the Tianshengqiao plant (800 MW) on the Hongshuihe on the upper reach of the Zhujiang; the Longyangxia plant (1,500 MW) on the upper reach of the Huanghe; the Wuqiangxi plant (1,750 MW) in western Hunan, and the Gezhouba plant (2,710 MW) on the upper reach of the Changjiang. Those planned to be built during the Sixth Five-Year plan period have a total capacity in the range of 20,000-24,000 MW. Those planned to be built during the Seventh Five-Year plan period have a total capacity of 40,000 MW. Every single power station that is to be built has a capacity of at least 1,000 MW.

As to the construction of thermal power plants, we are determined to implement the guidelines suggested by the Party Central Committee concerning the construction of mining district power bases to be constructed in close cooperation with the coal industry. The powerful coal-electricity bases are to be built by constructing clusters of electric power stations near mining districts. During the next decade or two, we plan to construct more than 10 thermal power bases in various mining districts including Huolinhe, Yimin, Shanxi, Mengnan, Lianghui, Shuzhou, Lunan, Yuxi, Liupanshui, Weibei, and Helanshan. The construction projects that are underway this year include the Datong No 2 plant (1,200 MW) and the Shuxian plant (1,350 MW) in Shanxi; the Huibei plant (750 MW) and the Huinan plant (600 MW) in the Lianghui area; the Shilicuan plant (500 MW) in Lunan; the Pingdingshan plant (1,800 MW) in Yuxi, and the Qingling plant (800 MW) in Weibei. A preliminary plan for the next decade includes construction projects with a total capacity of 70,000 MW. Every single power station that is to be built has a capacity of at least 1,000 MW and some have a capacity of more than 2,000 MW.

In summary, in the next decade or two or longer, the main energy resources exploited for the electric power generation in this country will be mainly coal and water. For the more distant future, we must aggressively develop nuclear power stations. We will strive to build two nuclear power stations in the southeast area sometime around 1990. As to the utilization of geothermal power, tidal power, wind power, solar power and methane gas for the purpose of electric power generation, our present task is to aggressively pursue and do well the research work, to carry out experimentation, and to forge ahead at a sure and steady pace.

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UPGRADING BACKWARD TECHNOLOGY, FACILITIES BOOSTS CONSERVATION

Hong Kong CHING-CHI TAO-PAO [ECONOMIC REPORTER] No 30, 30 Jul 80 p 7

[Article by: Cong Wenzi [0654 2429 3320]: "China's Energy Conservation Activities"]

[Text] China's energy resources are relatively plentiful. According to estimates, its coal reserve occupies third place in the world, its hydropower resource, first place, its oil reserves eighth place, and its natural gas 16th place.

However, China's energy utilization efficiency is very low. Although China consumes approximately the same amount of energy as Japan, its gross industrial production is only one-fourth that of Japan. This situation has caught the attention of concerned departments and great importance has been attached to it. In recent years, in order to alter this dismal situation, the ministries of industry have strengthened their control over energy resources, adopted various energy conservation measures, and achieved some significant savings last year amounting to 23 million tons of coal, 2.8 million tons of oil and 7.8 billion kilowatt hours of electricity.

I. New Technology, New Techniques, and New Materials for Energy Conservation

A large portion of energy wasted in China is attributable to the backwardness of its technical equipment and technology. An important route for energy conservation is the route of reforming backward production techniques and backward equipment and adopting a series of new energy saving techniques. This year, the government has set aside a definite sum of funds for the implementation of energy conservation measures, especially for the transformation of oil-burning industrial furnaces, electric power industry facilities, and for the development of waste heat utilization.

According to the energy conservation activities carried out by every province and city in this country, some of the new techniques, new technology, and new materials which have already been successfully applied and have gained popularity include, for example, the far infrared heating technique, new insulating materials, the new burner nozzle, the modified industrial furnaces and kilns, the waste heat utilization measures, and motor vehicle fuel conservation techniques. Among these, the far infrared heating technique alone, according to the statistics compiled in 21 of the provinces, cities, and autonomous regions in which the technique has been popularized and applied to the electric heating equipment with a temperature below 600 °C and a total capacity of 790 MW, can save 800 billion kilowatt hours of electricity and save more than 80 million yuan of capital each year. This new technique is widely being used in various fields of industry including the light and textile industries, printing and dyeing, food, medicine, electronics, machinery, and various other service industries.

Shanghai was among the first to use this new far infrared heating technique. The energy savings resulting from popularization of the far infrared heating technique is said to be as much as 50 percent. In Shanghai, the total capacity of the existing heating equipment with a temperature below 600 °C is 230 MW, and there are altogether 2,500 such devices in use with a total power of 130 MW. If every single device were converted to use the far infrared heating technique, the latent power that could be uncovered would be considerable.

The Tianjin Chemical Engineering Plant is one of the plants which consumes much energy. This plant increased its production while decreasing its coal and electricity consumption this year.

As part of the energy conservation activities, many units adopted a type of new heat insulating material--aluminum silicate--in their furnaces. In less than a year, more than 40 enterprises in Wuhan City have completely or partially replaced the old insulation on their furnaces with the new aluminum silicate fiber and, as a result, saved as much as 10 million kilowatt hours of electricity a year. The energy conservation department of Wuhan City has adopted the popularization of aluminum silicate fiber insulation in the Wuhan area as one of its main energy conservation efforts this year. In the Wuhan area, there are many heat-treatment furnaces with a total capacity of 70 MW. One-fourth of the furnaces will be remodeled this year, and when the remainder complete their remodeling next year, nearly 10 MW of electricity can be saved a year.

II. Scientific Management, Scientific Application

Another important reason why energy consumption is high in this country is the weakness of its energy management. More than one-half of the enterprises nationwide have not achieved the best historic energy consumption standard. The energy resource management system, including the waste heat utilization system, the energy resource balance system, and the consumption inspection system, either has not yet been established or has not been perfected. The energy waste attributable to improper management is still significant.

This grave situation has caught the attention of the economic construction department and a great importance was attached to it. In recent years, many provinces and cities have gradually moved toward establishment of an energy resource management system. As a result, energy resource management is gradually becoming more and more normal, systematic, and scientific.

Originally there were 187 heat-treatment plants in Nanjing with more than 1,700 workers and technical personnel, and more than 1,900 pieces of heat-treatment equipment processing approximately 24,000 tons a year. Most of these units used to waste electric power seriously and their equipment efficiency was very low. In order to transform the situation characterized by "big and complete" and "small and complete," and to increase the efficiency of energy utilization, two heat-treatment centers which transcend the enterprises were built one after another. One dealt with the regular heat-treatment businesses and the other handled the chemical heat treatment businesses.

These two heat-treatment centers have since absorbed more than [illegible] of the original heat-treatment businesses. As a result of specialization and large quantity continuous operation, both the energy consumption and the production cost have been significantly reduced. In the past, the electricity consumed per ton of heat treatment work was, on average, more than 3,000 kilowatt hours. Now with the centralized operation, only 900 kilowatt hours or so of electricity are required, with a reduction in cost of more than 150 yuan.

More than 770 Shenyang enterprises jointly organized an energy conservation coordination team composed of more than 17,000 persons. Of which, more than [illegible] persons are also a member of the 34 citywide specialty coordination groups. These technical coordination organizations have already demonstrated significant impact on the work related to the energy conservation and increased production. In order to solve a key technical problem related to the excessive energy waste in the [illegible] bakelite factory, the Shenyang Low-pressure Switch Plant organized an energy conservation assault squad and launched an attack to solve this problem related to the energy consumption of the 28 hydraulic presses. Within a period of 5 months, the 24 connected hydraulic presses were transformed into independent, automatic hydraulic presses. As a result of this transformation, 210,000 units of electricity, 11 tons of oil, and 12,000 tons of water are conserved each year.

The Tianjin Oil-black Plant and the Tianjin Machinery Plant are adjacent to one another. In the past, each of these two plants had its own boiler to generate steam for its own production and heating purposes, and the waste was quite [illegible]. In May of last year, these two plants signed a contract to share the steam. Now, the oil-black plant supplies the steam required for the production and heating for both plants and the machinery plant pays the coal and the cost. As a result of this arrangement, 350 tons of coal and 50,000 kilowatt hours of electricity are conserved each month together with savings in manpower and wages.

III. Exploitation and Utilization of New Energy Resources

In recent years, every province and city of this country has [illegible] established various societies, research institutes, and research groups related to the energy conservation effort. They have launched research work on new energy resources and started work on the exploitation and utilization of these resources.

Shanghai is one of China's heavy industry bases. However, Shanghai produces neither coal nor oil. It does not have natural gas and its hydropower resource is also quite poor. In recent years, the experts, the professors, and the scientists belonging to various societies including petroleum, nuclear energy, and solar energy, gathered together and broadly discussed and carefully investigated the energy resources of Shanghai. It was the unanimous opinion of these experts that the problem must be attacked from both fronts--conservation on the one side and development on the other. They consider that a nuclear energy power plant ought to be developed as soon as possible. Shanghai has a good industrial foundation, good coordination, a strong technical force, and technical ranks capable of designing and constructing a nuclear power plant. The concerned scientists have submitted "A Proposal Concerning Development of Nuclear Power Plant in the Huadong and Shanghai Areas" to the government for consideration.

Tidal power generation has many advantages, including an unexhaustible energy supply; the power station does not take up land, no resident need to be displaced; there is no need to expend fuel, and there is no pollution problem. Therefore, many areas are seriously considering utilizing this energy resource for the production of a secondary energy--electricity. The Baisakou tidal power station has accumulated more than 10,000 operating hours with good results. Utilization of geothermal energy for electric power generation has been shown to be economically feasible in some 10 units, and utilization of wind power for electric power generation has also seen preliminary success. Use of methane gas, which is being widely popularized in rural villages, can not only solve the shortage of energy in the villages but also partially solve the urban waste water treatment problem.

9111
CSO: 4008

CONSERVING ENERGY AS A LONG-RANGE STRATEGIC POLICY

Hong Kong CHING-CHI TAO-PAO [ECONOMIC REPORTER] No 30, 30 Jul 80 p 8

[Article by Hua Neng [5478 5174]: "A Profile of an Energy Work Conference Attended by the Industry and Transportation Departments of a Portion of Provinces and Cities"]

[Text] The energy problem is a problem being witnessed all over the world. It is also a major problem for a China striving to realize the four modernizations because the energy problem significantly affects the progress toward this goal. In the past 30 years, China's total energy production has increased 28 times over that of the early days of liberation, and now ranks among the world's larger energy producers. However, because too much energy is consumed, the development of the fuel and power industry could not catch up with the development of the processing industries, which constitutes one of the outstanding contradictions of China's industrial production. This year, China's industrial production should grow by 6 percent, but energy production is held at approximately the level of last year. Based on the scale of construction, energy production in China is not expected to increase significantly in the near future. Therefore, conservation of energy and elimination of energy waste should be one of the important routes we must follow today and a few years to come in order to ease the shortage in the fuel and power supply and to guarantee a continued growth of the industrial production. It ought to be a long-range strategic plan. An energy conservation conference was held recently in Tianjin, attended by the persons in charge and the energy experts representing 15 provinces and 12 industry and transportation departments. The deputy director of the State Economic Commission in charge of energy, Xiao Han [5618 1383], spoke at the meeting. The theme of the conference was to discuss how the energy conservation work in China may be carried out thoroughly.

I. Since last year, every area and every section nationwide have paid a special attention to the energy conservation in their effort to increase production and decrease waste. Especially since November, when the first national "energy conservation month" activity was launched, they have further strengthened the leadership of the energy conservation work and the energy management at the industrial and transportation fronts. As a result, significant results have been achieved in the effort to conserve energy. According to the statistics, altogether 23 million tons of coal, 2.8 million tons of oil, and 7.8 billion kilowatt hours of electricity were conserved last year, equivalent to a saving of 23.6 million tons of standard fuel. Of this, savings achieved by the industrial and transportation sectors amounted to 18.2 million tons. Although China's energy production increased only 2.84 percent last year, it was able to guarantee a growth rate of 8.5 percent for industrial production, thus realizing both energy conservation and increased production. Between January and April this year, energy production increased 1.5 percent compared with the same period last year, while industrial growth was 14.1 percent over the same period.

However, those who attended the conference also pointed out that although we have achieved certain definite results in energy conservation work, development was unbalanced. The main problem we face today is the fact that a considerable number of units still lack a serious attitude toward the grave situation of wasting energy. There are still more than 20 products whose energy consumption index has not reached the best historic level, according to an investigation carried out by the state on a number of major products. As to energy management, many enterprises in China today have not strictly implemented the norm management of the energy conservation on every product, while many large and medium enterprises do not have the necessary means to measure and calculate energy consumption. Furthermore, we are still far behind in the rational and general utilization of energy. In summary, there is a great deal more work that needs to be done in the field of energy conservation.

II. There is a great potential for energy conservation in China. Some experts pointed out during the conference that China's energy utilization efficiency today is only 30 percent or so. If we could increase the energy utilization efficiency just 1 percent a year, so that by 1985 China's energy utilization efficiency may reach 35 percent, this would be equivalent to an increase in 100 million tons of standard coal. Take some specific industries for example. There are more than 50 medium and small aluminum plants producing 25 percent of the total aluminum production. The nationwide average electric energy consumption per ton of aluminum is 17,500 units, with a minimum of some 15,500 units and a maximum of as much as 24,900 units. If, on the foundation existing today, every medium and small aluminum plant could reduce its electric energy consumption per ton of aluminum by 1,000 units, nearly 100 million units of electricity could be conserved nationwide. There are more than 300 medium and small carbide plants nationwide, producing approximately 50 percent of the total carbide production. Many enterprises consume more than 4,000 units of electricity per ton of carbide produced. If, on the foundation existing today, every medium and small carbide plant could reduce its electric energy consumption by 100 units per ton, 110 million units of electric energy could be conserved nationwide. The average energy consumption of China's large, medium, and small synthetic ammonia plants is 20 million major calories or so. That is to say that China spends twice as much energy for the production of one ton of synthetic ammonia as the world's advanced level. The total volume of coal gas released from blast furnaces, coking furnaces, and rotary kilns in China's metallurgical sector in 1979 was approximately 8 billion cubic meters--equivalent to 1.3 million tons of standard coal. The waste heat produced by industrial and transportation enterprises equivalent to more than 30 million tons of coal has not yet been fully utilized. It is evident that the potential for further energy conservation in China is still quite great. The experts were unanimous in opinion that China consumes too much energy with a great waste, and the main reasons lie in unsound management, outdated equipment, and backward technology.

III. During the conference, various routes for energy conservation were discussed and experiences related to this subject were exchanged. First of all, energy management must be strengthened. The largest industrial city in China--Shanghai--has done this work quite well. They have implemented a citywide overall energy supply plan. Following the implementation of the planned supply of electric power, coal, fuel oil, petroleum products, and gas, they have, since January of this year, begun planned supply of water to the 209 enterprises (which consume 50 percent of the industrial water citywide) consuming more than 50,000 tons of water a month in order to promote conservation of water. By the end of March, a total of 88 water conservation measures had been implemented by those 200 or so plants, and the water consumption during the first quarter this year was found to have decreased 5.1 percent compared with the same period last year, conserving 3.5 million cubic meters of water and achieving rather good results. After the planned supply of water was implemented, the 13 large plants belonging to the metallurgical bureau strengthened their management of water consumption, solved the measurement problem, and utilized the recycled water, and thus conserved more than 1.4 million tons of water during the first quarter. The city plans to expand the range of planned supply of water to include those enterprises consuming more than 10,000 tons of water a month starting out the third quarter, and thus brings 80 percent of all industrial water consumers into the planned supply system.

The facilities and the production technology used by China's industrial and transportation systems are out-dated. Therefore, energy conservation work must emphasize technical innovation, improvement of facilities, and the reform of technology. Energy conservation activities must be coordinated with their technical transformation; energy conservation must be built upon the foundation of a basic transformation of the entire industry. The effort in this area by a few plants has reaped some preliminary results. The Shanghai solvent plant belonging to the chemical engineering sector has transformed its "heat-consumption type" technology into an advanced "heat-supplying type" technology. It has achieved advanced world standards as far as the extent of its heat utilization is concerned. A new technology of transmitting crude oil at normal temperatures or intermittently which has been popularized by the petroleum industry is an important measure to reduce evaporation loss of the crude oil and natural gas. For transmission of crude oil, a heated flow process was adopted and a double-pipe or a triple-pipe pipe line were used. This type of flow process used too much steel and the evaporation loss was significant, so it was difficult to manage. Today, there are more than 2,000 oil wells which have switched to the normal temperature transmission technique. The Capital Steel Company has installed a new type of coal powder spraying device at the wind duct of its blast furnace. Anthracite powder is blown into the blast furnace through this device, substituting a portion of the more expensive coke, and achieving very good results. After this new technique was adopted, the four blast furnaces of this company in last year alone have conserved more than 200,000 tons of coke, and an additional 68,000 tons of coke during the period from January to April this year. The experts consider that this is a new undertaking in the steel refining technique, and it has special significance from the viewpoint of energy conservation.

9113
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STATE ECONOMIC COMMISSION DEPUTY CHAIRMAN DISCUSSES ENERGY CONSERVATION

Hong Kong CHING-CHI TAO-PAO [ECONOMIC REPORTER] in Chinese No 47, 26 Nov 80 p 4-5

[Article: "Xiao Han [5618 1383], Deputy Chairman, State Economic Commission Talks About China's Current Situation in Energy Conservation and the Tasks of the Coming Year"]

[Text] Recently a correspondent from this journal interviewed the deputy chairman of the State Economic Commission, Deputy Chairman Xiao Han, inviting him to talk about China's current situation in energy conservation and the tasks for the coming year.

[Question] China's industrial and communications enterprises are currently vigorously launching a campaign to conserve energy resources. Please talk about the significance for the four modernizations of energy conservation.

[Answer] Energy is an important material foundation for the realization of socialist modernization. Conservation of energy resources is a strategic task. During the past 30 years since the founding of the People's Republic, China has made tremendous accomplishments in the development and use of energy resources, and now has quite a solid foundation. It is estimated that energy output during this year alone will equal 614 million tons of standard coal. In terms of total quantity of output, the scale is not inconsiderable. For a long time, however, partly because development of energy resources has lagged behind the speed of development of industry overall, and partly because of the antiquated management of enterprises and high consumption, production of energy has still not been able to meet the demands of industrial and agricultural production and the people's livelihood. During the past 10 years or so, in particular, no change has been effected in China's energy shortage. The energy problem has become a prominent one in the development of the national economy.

Not long ago, the State Council studied China's energy situation and set forth a program to solve the energy problem that placed equal emphasis on development and conservation. More recently, priority has been given to energy conservation, and vigorous efforts aimed at conservation have been made to transform technology and improve construction. This has been a policy that proceeds from China's realities, and one that seeks truth in facts.

In order to hasten development of China's energy industries, the Central Committee and the State Council have taken note of China's actual energy situation to prescribe priority development of coal and hydroelectric power, active prospecting for and development of petroleum, building of nuclear electric power stations in energy short areas, and vigorously develop methane production in rural villages. In the coal industry, oil mining regions possessing good energy resources have intensified technical improvements and expanded the mines, have given priority to development of new coal fields, have built large coal-fired electric power bases, and the electric power industry has concentrated on the development, one after another, of a series of hydropower stations along stretches of rivers where water energy resources are abundant. They have developed high capacity thermal electric plants and extra high voltage transmission of electricity. The petroleum industry will hasten petroleum prospecting in China's west and on the sea, and strive to increase the recovery ratio from existing oil fields to create conditions for a fundamental solution to China's energy problems.

The internal ratio of China's energy industries is currently imbalanced. Considering the heavy tasks of readjustment plus the small amount of construction underway, no great growth in energy output will likely occur in the near future. Therefore, in order to assure a definite speed of growth of the national economy, energy conservation has to be placed in a priority position. This is a most realistic and most effective measure for the development of production during the next several years.

Placing of energy conservation in a priority position for the near term accords with China's present actual circumstances. China's economic base is weak, and there are many things to be done, so the concentration of large amounts of financial and material resources for development is difficult. In addition, the construction period for energy resources is long, and from a time standpoint, such construction cannot solve current problems. Therefore, we must start with energy conservation to use less energy in order to assure that the national economy develops at a definite speed.

Attention to energy conservation is not only for the purpose of solving the current energy shortage problem, but has more far reaching significance. Inasmuch as the administration and management of China's enterprises is presently quite inadequate, its technology and equipment antiquated, its industrial structure irrational, in short, inasmuch as it is an "energy wasting" structure rather than an "energy saving" structure, the transformation of technology and reform of the structure for the purpose of saving energy promotes transformation of technology and renovation of equipment, giving impetus to development and improvement in the entire industrial sector, to help gradually transform China's energy wasting economy into a proportionally energy saving economy, and to bring about an increase in the scientific level of management of industry as a whole as a result of intensified management of energy for energy conservation. In these senses, the process of energy conservation possesses major significance for the promotion of the four modernizations.

[Question] What accomplishments have been made during the last 2 years in energy conservation in China? What further potential is there for energy conservation?

[Answer] We have made great accomplishments in energy conservation during the past 2 years. Though there was only a 3.1 percent increase in the production of energy between 1978 and 1979, an 8.5 percent industrial growth was maintained. Last year about 23 million tons of coal, 2.8 million tons of petroleum, and 7.8 billion kilowatt hours of electricity were conserved. This translates into a total of 23.6 million tons of standard coal. Between January and September this year, a total of 25 million tons of standard coal was conserved with less use nationwide. Though there has been no fundamental increase in production of energy, industrial output value grew 11.7 percent over the same period last year. However, China's energy conservation work is still in its preliminary stage. It has to be realized that most of the conservation and reduced use of energy during the past 2 years has derived from preliminary strengthening of management and readjustment of the industrial structure and the commodity structure, with some small changes here and some small reforms there in techniques, technology, and equipment. But major renovation and reform work has scarcely begun, and the energy potential has not been tapped. But just how large is China's energy potential? Because China's raw materials and fuels are differently structured than in some industrially advanced countries, and since technological processes and technical equipment is somewhat antiquated, and management levels in enterprises not high, the proportionate consumption of standard coal to smelt a ton of steel is 1.6 tons, while it is 0.77 tons in Japan. So China uses 28.5 million tons more annually. To provide 1 kilowatt hour of electricity, China consumes 453 grams of standard coal, while Japan uses 334 grams. In the course of a year, China uses 27.5 million tons more. In China production of 1 ton of synthetic ammonia consumes 2.7 tons of standard coal, while in Japan it is 1.2 tons. In a year, China uses almost 20 million tons more. During last year alone, total consumption of standard coal for the manufacture of the aforementioned three products was 36 million tons, or 13 percent of total national energy consumption. Of course, there are factors that cannot be compared in the composition of some of these raw materials and fuels. There is a need to remedy the technological gap, and there is need for long term effort to bring about fundamental improvements in technology and equipment.

From the simple circumstances above, it may be seen that the potential for energy conservation in China is very great. But conservation of energy is an arduous task requiring expenditure of much effort. This is because there has been no improvement in the large amount of technologically inferior equipment in China. Most of the technological equipment currently in use by industrial and transportation enterprises dates back to the 1940's or 1950's, and it consumes a lot of energy. For example, one-third of the 180,000 industrial boilers throughout the country are old, consume excessive amounts of energy, and should be replaced or scrapped. Second, industrial production has not been scientifically and sensibly organized. Owing to limitations in current regional management systems and the effects of small scale production methods whereby everywhere there is "small but complete," or "large but complete," and everyone making a total thing without any cooperation with others, a great waste is created in the use of energy. Take waste heat from industrial production, for example. Nationwide, about 80 percent of it is not put to use. Third, energy management is quite weak. Energy consumption lacks fixed quotas, and lack of consumption metering is fairly universal. Fourth, no readjustments have been made in a group of small nitrogenous fertilizer plants, small blast furnaces, and small cement plants where energy consumption is high and deficits severe.

[Question] Please tell us what next year's energy conservation tasks will be.

[Answer] Recently the State Council discussed China's economic situation, deciding that the guiding thought in next year's economic work will be further readjustment and continued maintenance of economic stability. In the process of further attention to readjustment, energy conservation is an extremely important ingredient. How well this conservation succeeds will effect, to a very large extent, the speed of development of the national economy. Now, it is necessary to act in terms of the entire national economy to closely combine readjustment with energy conservation. It is preliminarily planned that during the period of the sixth 5 Year Plan, an average 20 million standard tons of coal will be conserved annually. Next year's energy conservation quota is: less use and conservation of 24 million tons of standard coal, including a saving of 4.5 million tons of petroleum, a saving of 20 million tons of coal, and a saving of 7 billion kilowatt hours of electricity.

[Question] Please discuss what conservation measures will be emphasized next year in order to fulfill this quota.

[Answer] 1. Continued readjustment of the industrial structure and the commodity structure, combining economic restructuring and energy conservation.

For a long time, China's heavy industry has accounted for about 30 percent of national income, while its energy consumption has amounted to more than 50 percent. The proportion of income in the national economy derived from light industry has been around 20 percent, while its energy consumption has been less than 10 percent. For every 100 million yuan of output value, energy consumption by heavy industry has been about five times that of light industry. This means that limited energy resources are not giving their full economic benefits. In view of the supply situation for raw materials and energy resources, appropriate increase of the proportion of light industry in the national economy in a gradual readjustment to a proper proportion is a major way to increase use of energy and economic benefits. Some fairly great changes have taken place in the structure of light and heavy industry during the past year. As of end September, the proportion of output value from light industry increased from 42.1 percent during the same period last year to 45.7 percent. Next year, there will be continued readjustment in the structure of industry to increase the proportion of light industry by another 1 percent over what it is this year. Simultaneous with this will be continued readjustment of the commodity structure inside industries, such as a decrease in pig iron castings, and increased use of scrap in blast furnaces, thereby decreasing the proportion of iron and steel. Currently China's ratio of iron to steel is 1.03 to 1, but with a reduction next year in the use of iron to make castings and increased use of scrap steel, it will be reduced to 1 to 1. More than 1 million tons of coal can thus be conserved. Full use of phosphorous and potassium resources to increase the quantities of phosphate and potash fertilizers so urgently needed in agriculture, and to adjust the proportions of nitrogen, phosphate and potash. In the light textiles, construction materials, machinery, and coal industries there are also problems in the readjustment of the commodity structure. With these reforms, the same amount of energy resources will create more social wealth.

Enterprises with high energy consumption that produce goods of shoddy quality and run up large deficits must be resolutely closed down and converted. This is not only a major way to conserve energy, but also an important aspect of economic readjustment. Small steel and iron works, small chemical fertilizer plants, and small aluminum plants that compete with large enterprises for raw materials, fuel and power, and transportation must be shut down and converted.

There must be further organization of production in accordance with the principles of specialization and cooperation to make a rational organization of scattered heat treatment points, electroplating points, and casting and forging points in order to reduce waste of energy resources.

Along with readjustments to the structure of industry and the structure of commodities must be the institution of complementary policies for the distribution of energy resources under the general principle of priority maintenance of light industrial production, maintenance of production in the Shanghai and Tianjin areas where industry is fairly concentrated, maintenance of low energy consumption with good quality, maintenance of production by enterprises producing products for sale that are needed, and appropriate control over supply of energy resources to industries such as metallurgy in which energy consumption is high, adopting firm measures with continued close downs and conversions.

2. Greater efforts to improve antiquated equipment and technology that consumes large amounts of energy.

The presently antiquated state of China's technology and technical equipment is the main reason for the high consumption of energy. According to preliminary statistics, of the more than 26,000 items of machinery and power equipment returned to the First Ministry of Machine Building, 55 percent was old articles from the 1940's and 1950's. Therefore, insofar as state financial and material resources and technical conditions permit, there should be a planned step by step technical reform on the twin premises of it being easier to do it earlier rather than later, and quickness in action now can permit slowness in action later.

First of all, mostly for the sake of energy conservation, there has to be improvements in machinery and electrical products with gradual replacement and updating of high energy consumption equipment. Machinery departments are already considering the design and manufacture next year of new type industrial boilers that are low in energy consumption and high in heating efficiency, and improvements in the power systems of automobiles and tractors. With the production of new type energy saving equipment will come the gradual scrapping of high energy consumption low efficiency equipment.

Secondly, in the process of technical improvements, each industry should vigorously reform technology, renovate equipment, promote new energy saving techniques and new materials, such as far infra-red heating, blowing of powdered coal into blast furnaces, and transporting of crude oil at ordinary atmospheric temperatures.

Third is intensification of scientific research work with the step by step organization of research departments, institutions of higher learning, and enterprises to undertake research in new technology for energy conservation, with the emphasis on energy conservation problems for which results can be derived in the short term.

3. Continued fierce attention to scientific management of the use of energy resources.

During the current period of readjustment of the national economy, intensification of management continues to be the key link in energy conservation. China's high energy consumption and great waste of energy are inseparable from the antiquated state of management of energy resources. During the first half of last year, according to statistics from 10 key enterprises in industry and transportation, 15 of 23 fuel and power consumption indicators did not reach highest recorded levels. During the first half of this year, energy consumption indicators for 22 of the 38 major products on which the state maintains a check did not attain the best levels every recorded. Aside from a small number of these products for which a reasonable increase in energy consumption occurred as a result of an increase in the rate of mechanization, for most, a large amount of energy was wasted because of low levels of management. Next year, it will be necessary to continue to expend a large amount of effort to give attention to management work.

It is necessary, first of all, to start with energy management, and to do a good job of making a general survey of energy resources utilization and heat balance, proceeding from this foundation to set up and perfect a management system with fixed quotas for energy consumption. First, for enterprises with an annual energy consumption of 50,000 tons of standard coal, heat balance should be instituted for a limited period and advanced and sensible energy consumption quotas formulated. During the next two years, all large and medium size enterprises in China will have to be substantially fitted with various kinds of energy consumption measuring and monitoring instruments.

Second, corresponding organizational structures must be set up to act in accordance with the pertinent regulations from the State Council; any region or sector that has not set up an energy management organization to set one up at once. Enterprises are to institute systems for energy management at the three levels of plants, workshops, and plant teams and groups, setting up special organizations for the purpose. At the same time, they should take in hand the training of energy management cadres and workers concerned with energy production and operation to improve the level of management and technical operating levels.

Third, pertinent laws and regulations regarding energy conservation should be enacted with all possible speed. Economic rewards and punishments should be enacted to spur energy conservation.

9432
CSO: 4006

FUTURE EXPLOITATION OF HYDROPOWER, COAL, PETROLEUM AND NATURAL GAS OUTLINED

Hong Kong CHING-CHI TAO-PAO [ECONOMIC REPORTER] in Chinese No 47, 26 Nov 80 pp 6-7

[Article by Neng Wei [5174 0251]: "China's Energy Resources and Their Exploitation"]

[Text] Coal, petroleum, and waterpower are currently the three mainstays of China's energy resources, providing the material foundation for the realization in this century of the four modernizations. A newly formulated energy program for China pointed out the need for equal emphasis on exploitation and conservation, with conservation being given a priority position for the immediate future. Considering the particular make-up of China energy resources, for a long period of time exploitation of coal and waterpower will occupy a priority position. Naturally, petroleum will not be excepted either.

China's principal energy resource is coal. Last year, coal accounted for 70.6 percent of China's energy resources; petroleum and natural gas accounted for 21 percent; and waterpower accounted for 3.3 percent. It is anticipated that no great change will occur in the make-up of China's energy resources within the next 20 years.

A brief analysis follows on the outlook for the exploitation of China's coal, waterpower, and petroleum resources.

Coal

China has extremely abundant coal resources. Already confirmed reserves amount to 600 billion tons, more than the total for all the countries of Europe (the Soviet Union excepted), and several times more the total for all the countries in the Americas (the United States excepted). The coal comes in a full range of varieties and is widely distributed throughout the country, and reserves are particularly abundant in North China, the Northeast, East China, and the Northwest. The coal reserves in Shanxi and Nei Monggol in North China amount to 65 percent of the country's total. Coal reserves available for exploitation in Shanxi Province amount to 200 billion tons, and in Xinjiang, Anhui, and Henan, coal reserves are in excess of 15 billion tons.

Since 1978, China's annual coal output has been stable at somewhat more than 600 million tons. Mining bureaus with a current annual production of more than 10 million tons are Kailuan, Fengfeng, Yangchuan, Datong, Huaibei, Pingdingshan, Fushun, Fuxin, Xuzhou, Jixi, and Hegang. Those with an annual output of from 5 million to 10 million tons are Xishan, Tonghua, Shihuijing, Tongchuan, Shuangyashan, Zaozhuang, Huainan, Jiaozuo, and Xinwen.

The coal industry will be carrying a major burden in the building of the four modernizations. The overall policy for exploitation of coal is fullest use of the old bases, selection of the best for exploitation, a rational pattern of production, expansion in the scale of mining construction, hastening the pace of mining construction, and satisfying the needs of the national economy to the greatest possible extent.

For the near future, fullest use must be made of the old bases. The old mines have to be readjusted, improved upon, and a steady production maintained, while at the same time expanding the construction of some old mine shafts to enlarge their production capacity. The mechanization of mining must also be actively and gradually increased, and the productive capacity of the more than 1,200 county operated regional coal mines throughout the country must be solidified. Last year regional coal mines produced 278 million tons of coal. Technical improvements have to be made in regional mines, and improvements are currently being made in 1200 of them.

Coal mine construction takes a long time, therefore, beginning now there will be gradual expansion in the scale of construction, and a quickening of the pace of construction to increase the ability of new shafts to go into production, so that mines currently under construction will produce 120 million tons next year, and mines already in production will increase production capacity by 10 million tons.

New mines must be selectively exploited and rationally distributed over different areas, with both consideration for resources, geological conditions, the situation in transportation, and a striving for economic results, and with consideration to balance in regional energy resources and close coordination among thermal electric power stations so as to reduce the transportation of coal over long distances.

Over the long term, the following several regions should be the major ones for exploitation. Shanxi Province in North China is the number one development area. In this Shanxi key development area are: Datong and Shuoxian for development into a first rate coal power base; Yangquan and Jincheng for development into an anthracite coal base; the mountains to the west of Taiyuan, Gujiao and Xiangning for development into a base for the coking of coking coal. In China's economically developed East China region, intensified development of Huaiyin, Huaian, Yanzhou, and Xupei coal regions to mitigate the contradiction of a coal shortage in East China. In these three mining regions, the veins of coal are even and suited to large scale mining. Inland waterways and land transportation in the region is convenient. In Huaiyin, Huaian, and southwestern Shantong Province, two thermal electric power bases should be built. Vigorous efforts should be made to develop the coal fields of the Northeast. The Northeast is China's heavy industry and commodity grain base. In Liaoning, Heilongjiang and three banners of Nei Monggol, coal reserves amount to more than 60 billion tons. This coal may both be shipped to the three northeastern provinces to supply the needs of agricultural and industrial production, and used in the area itself in thermal power plants to be built at Huolin River and Yimin River to supply electricity to the Northeast. Development of the coal fields in central and western Henan should continue, including those at Pingdingshan, Yima, Xingeng, Dengfeng, and Yuxian. These coal fields would mostly supply the south central region, with additional construction of thermal electric power bases in western Henan to feed electric power into the East China grid. Other provinces (and regions) should selectively exploit some coal mines to supply their own province or region or to help out other provinces or regions.

Waterpower

China's waterpower reserves total 680 [sic] million kilowatts of which 370 million can be harnessed for the generation of electricity. As of the end of 1979, China's installed hydropower capacity was 16.05 million kilowatts (of 500 kilowatts and above), amounting to only 4.3 percent of the potentially exploitable waterpower resources. When small hydropower generators throughout the country are added to this, it still amounts to only around 5 percent of exploitable waterpower resources. Thus, it may be seen that exploitation of China's waterpower resources has been extremely limited; that there is a great potential; and that it is a vast storehouse of energy.

The first hydroelectric power station in China was built at the Shilong Dam in Yunnan Province in 1910 and generated 1,440 kilowatts of electricity. By 1949, total installed capacity nationwide was only 163,000 kilowatts. During the 3 years immediately following Liberation, China built the Liujia Gorge Hydroelectric Power Station in Gansu Province with an installed capacity totalling 1.225 million kilowatts, the Danjiangkou Hydroelectric Power Station in Hubei with a total installed capacity of 900,000 kilowatts, the Xin-an Jiang Hydroelectric Power Station in Zhejiang with a total installed capacity of 662,500 kilowatts, and the Qingtong Gorge Hydroelectric Power Station in Ningxia with an installed capacity of 272,000 kilowatts as part of the construction of a total of more than 30 hydroelectric power stations with installed capacity of over 100,000 kilowatts. More than 10 hydroelectric power stations with a capacity of below 100,000 kilowatts and down to 12,000 kilowatts were built, and a large number of small hydropower stations were also built.

Currently, twelve large hydroelectric power stations, with a total installed capacity of 11.4 million kilowatts are either under construction or about to be constructed. Among them are the Gezhou Dam Hydropower Station with a total installed capacity of 2.71 million kilowatts, the Longyang Gorge Hydropower Station with an installed capacity totaling 1.5 million kilowatts, the Wuqiangqi Hydropower Station with an installed capacity of 1.5 million kilowatts, and the Baishan Hydropower Station with a total installed capacity of 900,000 kilowatts. A number of medium size hydropower stations are currently being speeded to completion, or work preparatory to construction is underway.

We have summarized below the distribution of China's waterpower resources and how to utilize these precious resources.

China's waterpower resources are concentrated primarily in its southwestern provinces and regions, which account for about 70 percent of the country's total waterpower resources. In Sichuan, Tibet, and Yunnan, there are more than 100 million kilowatts. The second area of concentration is in the southcentral and northwestern parts of the country, each of which has about 10 percent. The Northeast, North China, and East China account for about 9 percent. Of the various river systems, the Yangtze River system contains more than 2 trillion kilowatts; the Yalu Tsangpo River system contains more than 1 trillion kilowatts, the Yellow River system contains more than 30 million kilowatts; the Pearl River system contains more than 20 million kilowatts; and the northeastern river systems and the southeastern coastal river systems contain about somewhat more than 20 million kilowatts. Of these, the Jinsha Jiang in the upper reaches of the Yangtze River, the Sanxia [three gorges] of the Yangtze River, and two tributaries, namely the Yalong Jiang and the Dadu He, the upper reaches of the Yellow River, and the Hongshui He in the upper reaches of the Xi Jiang are the key areas for the exploitation of waterpower in China. The 10 major hydroelectric power generating bases that hold the key to exploitation in China are distributed in the upper reaches of the Yangtze River, the upper reaches of the Yellow River, the Jinsha Jiang, the Dadu He, the Yalong Jiang, the Hongshui He, the Lancang Jiang, the Wujiang, and the rivers in western Hunan and in the Fujian-Zhejiang-Jiangxi region. In some of these, conditions exist for the construction of huge hydropower stations, and in more than 20 of them conditions permit construction of exceptionally large hydropower stations with an installed capacity of more than 2 million kilowatts.

The Jinsha Jiang in the upper reaches of the Yangtze River is the richest storehouse of waterpower resources in China. Excellent dam sites exist particularly in the section of the Li Jiang in Yunnan from the Naxi Autonomous County to Yibin in Sichuan Province where there is Hutiao Gorge, Baihe Gorge and Qiluodu. Eight tiers of electric power stations could be built here with a total installed capacity of about 50 million kilowatts. The area below the two mouths of the Yalong Jiang, the largest tributary of the Jinsha Jiang, is a key river section for development, which can be developed at 12 different levels for a combined installed capacity of almost 20 million kilowatts. Along the section of the Yalong Jiang from below Yali to the famous Jinping great river bend at Bazhe is a distance of 150 kilometers, but the straight line distance is only 16 kilometers. By drilling a tunnel to carry the water, a drop of 300 meters could be obtained, and this would be an extremely fine river section for development by water diversion. Development could take place here at two levels for an installed capacity of 6 million kilowatts. The Ertan Hydropower Station in the lower reaches is only 40-odd kilometers distant from the Panzhihua Steel Base and can have an installed capacity of 3 million kilowatts. In the three gorges of the Yangtze River, geological conditions are superb for an installed capacity of 25 million kilowatts. On the upper reaches of the Yangtze River, the Gezhou Dam Hydropower Station is now being built.

On the Yellow River from Qingtong Gorge in the Ningxia-Hui Autonomous Region upriver to the Longyang Gorge and the mainstream section of the river is a distance of 894 kilometers in which the river drops 1400 meters with an average volume of flow in the Longyang Gorge of 640 cubic meters per second, and an average flow in the Qingtong Gorge of 934 cubic meters per second. The volume of flow is steady; the quantity of silt is slight; and geological conditions are good. In view of the topography, 16 hydropower stations can be built here stairstep like at Longyang Gorge, Laxiwa, Zuola, Lijia Gorge, Gongbo Gorge, Jishi Gorge, Sigou Gorge, Liujia Gorge, Yanguo Gorge, Bapan Gorge, Xiao Gorge, Da Gorge, Wujin Gorge, Heishan Gorge, Hongmaoniu, and Qingtong Gorge for an installed capacity totaling 12.6 million kilowatts, and an annual generation capacity of 500 million kilowatt hours.

Projects slated for early construction like Liujia Gorge, Yanwo Gorge, Bapan Gorge, and Qingtong Gorge will have an installed generating capacity totaling 2 million kilowatts, and those now under construction such as the one at Longyang Gorge, where work began in April 1978, and those undergoing planning for Laxiwa, Lijiaxia Gorge and Heishan Gorge, will have a planned installed capacity totaling 5.5 million kilowatts.

The Nanpan Jiang and the Hongshui He, which traverse Yunnan, Guizhou, and Guangxi provinces, are also key centers for the development of hydroelectric power in China. The topography and geological conditions here make for superb dam sites. The area on the Nanpan Jiang is concentrated in the Tianshengqiao section of the river, where development can take place at two levels for a total installed capacity of 2.2 million kilowatts. The Longtan Hydropower Station is the faucet step in the development of the Hongshui He, creating conditions for construction at the various steps down river. This step will have an installed capacity of 3 million kilowatts. The Yantan Hydropower Station below Longtan will have an installed capacity of 1.5 million kilowatts. Datong Gorge, which is farthest down river, is 160 kilometers from Guangzhou and will have an installed capacity of 1.2 million kilowatts.

Along the Yuan, the Zi, and the Li rivers in western Hunan, more than 30 large and medium hydropower stations can be built with an installed generating capacity of more than 5.7 million kilowatts. The Wuqiangxi Hydropower Station on the Yuan is the largest hydropower station in this region with an installed capacity of 1.5 million kilowatts.

In the East China region where fuel is short, development of the electric power industry is extremely important. In Fujian, Zhejiang, and Jiangxi provinces, more than 80 hydropower stations, large and small, with an installed capacity totaling more than 10 million kilowatts can be built. Existing large and small hydropower stations number 15, with an installed capacity of 1.75 million kilowatts. Five large and medium size hydropower stations with an installed capacity of more than 1 million kilowatts are currently under construction.

When these waterpower resources have been gradually developed, the formidable electric current will be able to supply the needs of both local and other areas. Hydroelectric power from the southwest, in particular, will flow through 500,000 volt, 750,000 volt or higher voltage extra high voltage electric transmission lines to distant places. This means that electric power from the southwest will go to South China, Central China, and East China. In addition, hydroelectric power from the northwest will also be transported to North China.

In China's mountain regions, there are also numerous small creeks and rivers suitable for the construction of small hydroelectric power stations. This is a waterpower resource that merits full utilization. Small hydropower stations are characterized by small amount of investment, quick results, and low cost. More than 90,000 small hydropower stations have been built throughout China for an installed capacity of 6.91 million kilowatts, and the generation annually of more than 15 billion kilowatt hours. Throughout China, more than 730 counties (or about one-third of all the counties in the country) rely on small hydropower stations for their electricity. But in overall national terms, the untapped potential remains great for the construction of small hydropower stations in many places.

Petroleum and Natural Gas

Development of China's petroleum and natural gas resources is still at an early stage. Looked at in geological terms, the 9.6 million square kilometers of Chinese soil contain more than 4.2 million square kilometers of sedimentary rock area and more than 1 million square kilometers of coastal continental shelf with good oil-bearing prospects. As of the present time, prospecting has not yet been done in most areas, or else only a small amount of work has been done. In places where prospecting has been done, it has not been done to sufficient depths.

China now has more than 160 oilfields under exploitation. Last year, China's crude oil output ranked fifth in the world at 106.15 million tons. Natural gas output amounted to 14.51 billion cubic meters. This year's production of crude and of natural gas will remain substantially at last year's levels. But in terms of our populaton of almost 1 billion, this is very inadequate, and not commensurate with needs for realizing the four modernizations.

The main task at the moment in prospecting for and developing petroleum and natural gas is to maintain crude oil output at its present levels while concentrating our energies, our material resources, and our financial resources on intensified prospecting in a quest for new and better petroleum and natural gas resources, thereby greatly increasing crude oil output.

While land prospecting is focused on the oil fields in the eastern part of our country in a quest for oil fields deep down, there should be an intensification of oil field prospecting in the western part of the country. Ever since the renewed organization of forces in 1977, exploratory drillings in sedimentary pan have achieved fair success in Tsaidam, Tarim, Zhunkar, and in the Shaanxi-Gansu-Ningxia area.

Development of petroleum in the sea holds broad prospects. In the wake of the drilling last year of a high output well in the Pearl River Basin on the continental shelf of the South China Sea, No 7 well in that area has recently brought in crude oil. Experts at the South China Sea Northern Continental Shelf Fossil Stratum Conference convened in Guangzhou early this year unanimously believed that the South China Sea holds vast prospects for the development of a petroleum industry.

Between May and July last year, China signed agreements with 16 petroleum companies in the United States, the United Kingdom, France, and Italy for seismic surveys in eight areas along a line extending 100,000 kilometers in the South China Sea and the southern Yellow Sea with a total area of 110,000 square kilometers. This work was completed in July this year. Now, each company is in process of interpreting and evaluating the seismic data. On the basis of the data already analyzed, there is reason for believing that the crude oil situation in these ocean areas is very good, and developmental prospects are optimistic.

China has signed agreements with French and Japanese petroleum companies for cooperative development of known oil producing areas in Bohai and Tongking Gulf, and is currently in process of work preparatory to prospecting.

9432
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SMALL HYDROPOWER POWER STATIONS TO HELP EASE POWER SHORTAGE

HK190703 Beijing RENMIN RIBAO in Chinese 29 Jul 80 p 2

[Article by Zhu Xiaozhang [2612 2400 4545]: "Also Talk About Giving Priority to Developing Hydroelectric Power--Thoughts on Work of the Hydroelectric Power Specialists Group, Who Are Going to Take Part in the UN International New Energy Resources Session"]

[Text] At present, a tense situation in energy resources has appeared in the world. The utilization of all other new energy resources and the development and application of regeneratable energy to satisfy the world's total demand for energy have become an extremely important issue all over the world. The United Nations has decided to hold an international session on new energy resources and the possibility of reproducing new energy resources by 1981 and has set up an eight-member specialist group to prepare the technical documents for the session. Our country has been invited to join several groups. In February this year, I went to Vienna to take part in the first session of the hydroelectric power specialists groups, discussed the situation, learned something and had a profound feeling. Regarding energy resources, I have become thoroughly convinced that "we must give priority to developing hydroelectric power."

Many developed countries in the world have paid serious attention to developing hydroelectric power since the early 20th century. By 1925, the world's electricity supply generated by hydroelectric power accounted for 40 percent of the total electricity output. Whether a country has more waterpower resources and less mineral fuel (coal, petroleum), or a country is rich in both waterpower resources and mineral fuel of a county has less waterpower resources and more mineral fuel, they all give priority to developing hydroelectric power. Until the development of hydroelectric power is exhausted, we will have no alternative but to build more thermal electricity or nuclear electricity plants. At present, for example, in Italy, France, Switzerland, West Germany and Britain, the installed capacity of hydroelectric power accounts for 90 percent of the waterpower resources that can be developed. In Norway, Switzerland and Brazil, the proportion of electricity generated by hydroelectric power accounts for 80 to 90 percent of the whole country's electricity output. In many countries, the proportion of hydroelectric power gradually declines simply because the hydroelectric power that can be developed is almost exhausted.

Many experts in various countries openly admit that there are more than 10 advantages to generating hydroelectric power. They mainly include: they can be reproduced, their resources are never exhausted, they are not polluted, they can be used comprehensively, the hydroelectric power machinery and equipment are simple and reliable;

they can be operated easily, the starting and stopping are fast, they are suitable for use in frequency modulation and peak regulation; the technology is modern, the efficiency of the equipment is high and the installation is durable. According to incomplete statistics of the organizations concerned, the potentials of waterpower resources throughout the world are still very great. The waterpower resources that can be developed in the world are approximately 2.2 billion kilowatts. The current installed capacity is only 400 million kilowatts. According to evaluations, 80 percent of the untapped potentials can be explored within the coming 40 years. In some developing countries, only 2 percent of their waterpower resources have currently been developed. In some developed countries, the potentials of the unbuilt power stations along the reservoirs are also very great. For example, a recent survey in the United States showed that there were several tens of millions of kilowatts. Investments to make use of these resources are very economical. Therefore, at present, an upsurge of hydroelectric power has once again appeared in countries including the United States, Sweden, France and so forth which have already developed considerable waterpower resources. They have also shown very great interest in the small hydroelectric power stations which they considered uneconomical in the past. The UN Economic Commission for Europe has recently established a group to specifically reevaluate some sites for hydroelectric power stations which in the past were not regarded as worthy of exploration.

The theoretical potentials of our country's waterpower resources are 580 million kilowatts. The current development is less than 3 percent. The scale of development was originally very low. However, in the entire electricity output, hydroelectric power was reduced from 25 percent in 1957 to 17 percent in 1979. Although our country is comparatively richer in waterpower resources and mineral fuel, the current energy supply is also more tense. In view of the fuel consumption for energy, the consumption of coal and oil to generate electricity each year accounted for one-sixth of the output of coal and oil. This is very uneconomical. Some people said: "The water in the rivers flows continuously, but what has flown away are coal and oil." It is not necessary to further explain the reasons why we must make use of hydroelectric power as soon as possible, so that we can use coal and oil in other areas.

At present, most people around the world who are engaged in hydroelectric power stressed that it is necessary to make concrete comparisons in many aspects in launching a hydroelectric power project. Investments cannot be made simply on the basis of unit kilowatts. The average investment for our country's large and medium size hydroelectric power stations is 850 yuan for each 1,000 kilowatts. This is very economical. Besides, the larger hydroelectric power systems cannot be readjusted easily. The shortage of electricity during the dry season is an important problem that obstructs the development of hydroelectric power. Naturally, in countries or areas where the proportions of hydroelectric power is greater, the installed capacity of hydroelectric power must be suitably and rationally selected. In the past, the design of some of our country's hydroelectric power stations put too much emphasis on their scale. In some cases the difference between the installed capacity and the guaranteed output was too great. All this is worthy of further study. These are issues related to improving the design and strengthening the management and are not weaknesses in hydroelectric power that cannot be overcome.

In recent years, our country's development of small hydroelectric power stations has been very rapid and has gained more experience. By 1979 we had 90,000 small hydroelectric power stations throughout the country. The total installed capacity was 6 million kilowatts, accounting for 30 percent of the installed capacity of the hydroelectric power stations throughout the country. The speed of installation has also been rapid in recent years. In 1978 and 1979, the installation in each year was close to 1 million kilowatts. In 1979, the electricity generated by the small hydroelectric power stations throughout the country exceeded 10 billion kilowatt-hours, accounting for 35 percent of the electricity consumed by agriculture throughout the county. Since the activism of the masses and localities has been promoted, many small hydroelectric power stations (particularly in the provinces in the south) have been set up with the state providing fewer investments and loans. Therefore, although the costs for the unit kilowatt in the small hydroelectric power stations are generally higher than those of the large hydroelectric power stations, the small hydroelectric power stations are increasingly giving play to their important role in solving the problem of insufficient state investment in the course of economic development in developing countries. This is also a supplementary measure for satisfying the current needs for agricultural electrification. Internationally in particular, the developing countries also pay very serious attention to China's practice. The two relevant documents of this group of hydroelectric power specialists contained these two statements: "Although the proportions of the small hydroelectric power stations account for very little in the output of electricity in the entire hydroelectric power system, they can play a very important role in the agricultural areas of some developing countries," "in equipping the small hydroelectric power stations, China perhaps is the most experienced country." However, the group of specialists also stressed that "it is necessary to study ways of reducing the costs of building small hydroelectric power stations, increasing their reliability and choosing ways to improve linking of the small hydroelectric power with the major system."

In short, whether we look at the experiences around the world or our country's practical experiences, giving priority to developing hydroelectric power and increasing the proportions of hydroelectric power in the entire electricity output as soon as possible should be an important integral part in our country's policy on energy resources.

CSO: 4006

BEIJING RELYING MORE ON SMALL-SCALE HYDROPOWER GENERATION

Beijing BEIJING RIBAO in Chinese 26 Jun 80 p 2

[Article by Zhang Wuxiang [1728 0063 0686] and Liu Lianshu [0491 6647 2873]: "Fifty-seven Small-scale Hydropower Stations Completed, 56 More Under Construction; Small-scale Hydropower Stations in Beijing Suburbs Doubled in Number Continuously Over Last 3 Years"]

[Text] According to the Small-scale Hydropower Work Conference sponsored by the City People's Government recently, small-scale hydropower generation has doubled yearly over the past 3 years since 1977. The total installed capacity last year was 20,500 kilowatts, and 22 million kilowatt hours of electric power were generated; an increase of more than 6 times since 1977. During the first 4 months of this year, 9.56 million kilowatt hours of electric power were generated, surpassing the total electric power generated in 1978.

Previously, there were only 10 small-scale hydropower stations in the entire suburban area generating only 2-3 million kilowatt hours of electric power a year. After the National Small-scale Hydropower Conference was held in 1975, especially after Comrade Hua's visit to the Miyun Reservoir in 1977 and his speech concerning "water should be used for power generation before it is used for the purpose of irrigation," small-scale hydropower construction in the suburbs picked up speed. The enthusiasm at all three levels, county, commune, and brigade, was very high. During a period of only 3 years from 1977 to 1979, 47 new hydropower stations were built. The Henanying power station in Beizhuang Commune, Miyun County, broke ground in late autumn of the year before last. In less than half a year the construction was completed, with an installed capacity of 160 kilowatts. It started to generate power last May. By the end of the year it had generated a total of 410,000 kilowatt hours of electric power with an income of more than 20,000 yuan. The Tonghe Commune in Huairou County built a waterway 10 kilometers long in 1978. They built a dam of 320 meters long across a river, and built the Dongfang No 1 station with a total installed capacity of 375 kilowatts and began to generate power the same year. Last year, they expanded the work and built the Dongfang No 2 station on the same waterway with a total installed capacity of 500 kilowatts. These two power stations jointly generated a total of 3.06 million units of electric power, supplying two-thirds of the electric power consumed by the 8 communes in the mountainous area in the northern section of Huairou County. Among the small-scale hydropower stations in the suburbs, the Qidu, Xiguanshan, Mentougou, and Junzhuang stations in Fangshan county have operated for 5,000-6,000 hours each year (including that portion generated for self-consumption), and some others as high as 7,000 hours, reaching the advanced level of operation. Today, there are 56 more small-scale hydropower stations under construction around the city.

9113
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JINHUA HARNESSES ITS SMALL-SCALE HYDROPOWER POTENTIAL

Hangzhou ZHEJIANG RIBAO in Chinese 17 Jul 80 p 2

[Article by Xu Xianxuan [1776 6343 6693]: "Jinhua Area Has 100,000 Kilowatts of Installed Capacity in Small-scale Hydropower"]

[Text] Jinhua district has fully utilized its plentiful hydropower resource and by combining flood control and electric power generation in a single effort mobilized the enthusiasm of the masses to build many small-scale hydropower stations. By the end of June 1, 196 small hydroelectric power stations had been built with a total installed capacity reaching 102,178 kilowatts.

Jinhua district has many mountains and is laced with rivers, so it is endowed with considerably rich hydropower resources. According to a general survey, in addition to the two medium-scale stations built by the state at Niaoxijiang and Huangyunkou, there are 547 megawatts of small-scale hydropower resources that can be exploited.

In order to fully develop the superiority of these small-scale hydropower resources, Jinhua district has steadfastly implemented a principle of combining flood control with electric power generation. Along the waterways of existing reservoirs, power generating stations were built wherever possible. Starting from what the local conditions offered, hydropower plants with large head and small volume were built in the mountainous areas, while in the plains, hydropower plants with small head and large volume were built. Each county has accomplished electric power generation at all three levels of county, commune, and brigade. Except for a few key construction projects which were carried out by the district and some trunk stations under the jurisdiction of the county, various small-scale hydropower stations were built under various forms of management: commune or brigade alone, or jointly between commune and commune, between commune and brigade, or between brigade and brigade. In building these small-scale hydropower stations, they upheld the principle "he who builds it, owns it, manages it, and is benefited by it," in order to mobilize the enthusiasm of the masses to participate in this activity of combined flood control and electric power generation. So far, there are 2 large-scale reservoirs and 22 medium-scale reservoirs distributed all over the district. Small-scale hydropower stations have been built on all but 2 of the medium-scale reservoirs, with a total installed capacity of 41,435 kilowatts. More than 110 of the 170 small-scale reservoirs have small-scale hydropower stations with a total installed capacity of as much as 14,339 kilowatts. In addition, some areas have even utilized irrigation waterways and mountain brooks for small-scale hydropower generation.

Jinhua County, which is one of the nation's advanced units for construction and management of small-scale hydropower stations, takes the road of joint-venture electric power generation. They have adopted various forms of operation including joint commune-commune, joint commune-brigade, and brigade with public assistance. As a result, there are more and better small-scale hydropower stations in Jinhua County. By the end of May, there were 206 small-scale hydropower stations (of which 186 are of the joint commune-brigade type) with a total installed capacity of more than 2 megawatts.

Wuyi County has taken full advantage of its many mountains and rivers, and has made an overall, rational plan to exploit its hydropower resources. Today, there are 132 small-scale hydropower stations with a total installed capacity of 12,716 kilowatts. The Ministry of Electric Power Industry issued a written citation to Wuyi County at the National Conference of Small-scale Hydropower held in January this year.

Wuyi County is a mountainous area with criss-crossing rivers, so that its hydropower resources are quite abundant. According to a general survey, there are, countywide, approximately 50 megawatts of exploitable hydropower resources. These hydropower resources are distributed mainly along two rivers, the Wuyijiang and Wuxi, and 68 hydropower stations with more than 1,000 kilowatts capacity can be built there. The county has prepared graphs and charts according to the water system and the drainage basin and has drafted long-range as well as short-range plans.

Along Mayanggang on the upper reaches of the Wuyijiang, over a length of 40 kilometers, there is sufficient volume of water and sufficiently large head for 17 small-scale hydropower stations. Quick results can be achieved with small investment, therefore the county has decided to concentrate its efforts on developing this stretch of river. During the process of its development, they have adopted various modes of operation according to the different circumstances. The county has undertaken construction of four ladder-type power stations, and the rest are--under a unified plan--separately undertaken either by a joint commune-county venture, by a joint commune-brigade venture, or by a commune or brigade independently. This way of doing things mobilized the enthusiasm of the masses sufficiently so that in just a little over 2 years 14 hydropower stations were built along the Mayanggang. At present, all communes countywide, and more than 80 percent of the brigades and production teams have access to electricity.

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WATER-RICH ZHEJIANG LAUNCHES AMBITIOUS HYDROPOWER PROGRAM

Hangzhou ZHEJIANG RIBAO in Chinese 9 Aug 80 p 3

[Article by Gao Zhirui [7559 1807 3843]: "Developing Energy Resource Superiority and Stepping Up Hydropower Construction"]

[Text] Zhejiang's shortcomings in energy resources include little coal and no oil. However, the hydropower resources of this province are quite abundant, presenting excellent conditions for the development of hydroelectric power generation. This is Zhejiang's superiority in the energy resource field.

The mountainous areas occupy 71 percent of the total area of this province. The annual precipitation ranges from 1,200 to 1,800 millimeters. There are 8 major water systems, including Qiantangjiang, Wajiang, Feiyunjiang, Bijiang, Lingjiang, Zaoejiang, Yongjiang, and Tiaoxi. In addition, there are 13 small rivers which discharge directly into the ocean, and 14 rivers belonging to the Zhe-Ming-Gong water system. The rivers criss-cross the land, flowing in general from west to east and discharging into the East China Sea. On account of the high mountains and the large volume of water, the hydropower resource is estimated to be as much as 6 million kilowatts (excluding tidal power), with an exploitable installed capacity of as much as 5 million kilowatts (excluding stations smaller than 100 kilowatts in capacity), and generating a total of 15.6 billion units of electric power a year. According to the districts, those with exploitable installed capacity of more than 1 million kilowatts include Hangzhou and Lishui; 0.5-1 million kilowatts, Wenzhou and Jinhua; and 0.1-0.5 million kilowatts, Taizhou and Shaoxing. According to the 68 original counties and cities--excluding the Chuanshan and Jiaxing plain areas--there are 57 counties and cities where relatively abundant hydropower resources are available, amounting to 82 percent of the total counties and cities. Of these, there are 20 counties with a total installed capacity of more than 50,000 kilowatts, 22 with 10,000-50,000 kilowatts, and 15 with less than 10,000 kilowatts. Large- and medium-scale stations with a total installed capacity of more than 50,000 kilowatts, besides Xinanjiang, Fucunjiang, and Wuxijiang, where more than 1.04 million kilowatts of installed capacity have been installed, include Huangpu, Jinshuitan, Shikuang, Dachi, and Tankang along the Wajiang, the Baojiang hydropower station on the Nanxijiang tributary, and Shanxi and Zhaoshandu along the Feiyunjiang, a total of more than 1.1 million kilowatts. These station sites have been chosen and planned for a long time because they have the advantages of savings in investment capital, large generating capacity, and small loss due to inundation. There are many other medium- and small-scale station sites which have not yet been exploited such as Fengshulin, Huaguangtan, and Shizilin along the first-class tributary of Qiantangjiang. In addition, there are small-scale hydropower stations (single unit of 6,000 kilowatts and total installed capacity of 12,000 kilowatts or less) with a 420,000-kilowatt capacity which have already been exploited, with 2 million kilowatts yet to be exploited. These small-scale hydropower stations inundate very little cultivated land. In addition to receiving a certain amount of state assistance, the enthusiasm of the local masses can be mobilized for the construction of these small-scale hydropower stations, so that they can be built quickly and bring in large benefits. By the end of last year, the total capacity of hydropower stations provincewide was 1.51 million kilowatts, amounting to 29 percent of the total exploitable installed capacity. Therefore, Zhejiang's potential for hydropower development is very large.

To accentuate the strong points and avoid the weak, Zhejiang must fully utilize its hydropower resources. Hydroelectric power generation is economical and pollution-free, so that it is very convenient to use. On the other hand, hydropower stations are somewhat more expensive to build than thermal power stations. However, what the hydropower stations use is a cheap, clean, and renewable energy--"white coal." Although the initial capital investment may be bigger, its economic effects will be better in the long run. Thermal power stations burn coal or oil which are non-renewable resources. The combined total investment in coal or oil from exploration, exploitation, transportation, processing, to environmental protection measures is enormous. In fact, the investment made by the state in basic construction of a thermal power station is approximately the same as that of a hydropower station. However, construction of a hydropower station has additional economic advantages such as flood control, irrigation, fish culture, and navigation. Accumulation of capital by a hydropower station is also faster. It can accumulate 500 million yuan from generating 10 billion units of electric power. For example, the Xianjiang hydropower station was able to recover the capital investment after only a few years. Since then, it has accumulated a large sum of capital for the state.

The impact of small-scale hydropower stations on Zhejiang's economy can be quite significant. By the end of last year, there was a total of 420,000 kilowatts of installed capacity in small-scale hydropower stations with a capacity of 12,000 kilowatts or less. Fifty-five counties and cities provincewide which have hydropower stations. Of these, 17 counties have a total installed capacity in small-scale hydropower stations in excess of 10,000 kilowatts. Small-scale hydropower stations distributed like stars in the heavens can satisfy basic electric power needs in rural villages throughout the province, speed up construction of mountainous areas, provide cheap power for the development of industrial and agricultural production in cities as well as rural villages, and greatly contribute to the improvement of living conditions and cultural life of the vast majority of the masses. By connecting small-scale hydropower stations with large power grids, electricity is now available to 95 percent of the communes and 82 percent of the brigades in Zhejiang. Of these, the number of communes and brigades which depend on small-scale hydropower stations exclusively for their supply of electricity occupy 60 percent and 48 percent respectively of all the electrified communes and brigades. The mountainous areas in southern Zhejiang which are situated far from large power grids in particular depend exclusively on small-scale hydropower stations for their supply of electricity. After reorganization, and if management work is done well, the total electric power generated by small-scale hydropower stations can be expected to exceed 1 billion kilowatt hours this year. It will be equivalent to getting 500,000 tons of standard coal from Donghai each year at a low cost. Unfortunately, such a good thing failed to catch the attention of the concerned departments. For example, a vanadium mine in Pingyang County needed electricity. There was a small-scale hydropower station site nearby with a head of 150 meters. A reservoir having a capacity of 8 million cubic meters, which inundates a relatively small land area and possesses a huge regulating capacity, and a small-scale hydropower station with an installed capacity of 2,400 kilowatts could be built. On average, it could generate 8.6 million kilowatt hours of electric power a year, which could satisfy the needs for electric power by the vanadium mine. However, it was not exploited and utilized because the initial capital investment would be too high. Instead, a self-contained 1,500-kilowatt thermal power station was built. Now, coal has to be shipped from faraway provinces by train to Shanghai, then by waterway to Bijiang, then by highway over a distance of more than 60 kilometers to the vanadium mountain. The cost per every kilowatt hour of electric power thus generated is as much as 25 fen. Based on an annual electric power consumption of 7.2 billion kilowatt hours, the annual electric bill comes to 1.8 billion yuan. With hydroelectric power at 8.5 fen per kilowatt hour, the annual electric bill will be 612,000 yuan. In the past, we did not start from the actual conditions of Zhejiang's energy resources. Without clear understanding of the situation, we grasped coal blindly. As a result, we found a great expenditure with small return, and in the end we could not do anything but retreat. On the other hand, construction of small-scale hydropower stations for which we have a wealth of experience, from exploration, design to installation, from construction of machinery to construction of facilities, has not received due respect so that its progress has been slow. Hydroelectric construction is a strategic investment. We must fully develop the superiority of Zhejiang's hydropower resources, and let its plentiful hydropower resources serve the construction of the four modernizations.

9113
CSO: 4006

SICHUAN MAKES IMPRESSIVE STRIDES IN CONSERVING ENERGY

Chengdu SICHUAN RIBAO in Chinese 4 Sep 80 p 1

[Article by Wang Tong [3769 2436]: "Intensify Energy Management; Spread Advanced Techniques. During the First Half of the Year Sichuan Province's Industrial and Transportation Front Has Had Substantial Results in the Conservation of Energy"]

[Text] This year every echelon of leadership on Sichuan Province's industrial and transportation front has further emphasized the conservation of energy, has taken action to intensify energy management, reform technical facilities, and to spread advanced conservation techniques and experiences to obtain substantial results from energy conservation. For the first half of this year, the quantity of energy used throughout the province (converted to standard coal) showed an increase of only 5.36 percent over the same period last year, while total industrial output value increased 9 percent over the same period last year for an average decline of 2.9 percent over the same period last year in the consumption of energy per 100 million yuan of output value. Per unit consumption for most products declined from the same period last year for a great saving in coal, natural gas, electric power, and finished petroleum manufactures, making possible increases in production while saving energy.

As a result of the second nationwide "Energy Conservation Month" campaign launched last November, conservation of energy resources has aroused serious general attention on Sichuan Province's industrial and transportation front, and substantial progress has been made in energy conservation work. During this year, in the cities of Chengdu, Chongqing, Zigong, Dukou and in quite a few prefectures as well, various provincial level industrial and transportation bureaus and units such as the Provincial Coal Construction Company and the Provincial Petroleum Company have continued to set up energy conservation organizations, and have put into place further energy conservation tasks and measures. Zigong organized forces in the coal, electric power, petroleum, and gas sectors to establish a municipal energy conservation office for unified management of energy conservation work citywide. Seventy-six business enterprises and numerous shops, shop sections, and teams and groups in factories who used substantial amounts of energy set up energy conservation organizations and placed personnel in charge of energy conservation. At the same time, they instituted the third citywide major investigation on energy conservation, checking on waste and plugging leaks to expand the effectiveness of energy conservation. During the first half of the year, citywide use of natural gas declined by 16.3 percent over the same period last year while total output value still increased by 8.3 percent over the same period last year. Some prefectures, departments, and enterprises conducted general energy surveys, investigation and reappraising consumption norms, setting up and perfecting energy management systems, installing measuring devices and instruments, training thermotechnical management personnel, and intensifying basic work in energy conservation. Key metallurgy enterprises such as the Panzhihua Steel Company, the Great Wall Steel Plant, the Chengdu Seamless Steel Tube Plant, and the Chongqing Steel Company have conscientiously strengthened management over energy, setting consumption norms for individual manufacturing processes, and installing measuring devices on equipment in workshops and sections of workshops that are the principal users of energy in an effort to do a good job of balancing heat with work done. The job of converting gas burning boilers to coal burning is also moving ahead well. According to incomplete statistics from the three municipalities of Chengdu, Chongqing, and Zigong, as of end May, 83 boilers had been converted to the burning of coal and no longer burned natural gas. This amounts to 24 percent of the boilers requiring conversion for a daily saving of 237,000 cubic meters of natural gas.

During this year, many departments and enterprises improved technical equipment mostly in order to conserve energy, and have spread advanced techniques and advanced experiences, thereby effecting a gradual decline in consumption of energy. The provincial chemical industry bureau system cut back on auxiliary boilers in 22 small nitrogenous fertilizer plants for a saving during the first half of the year of 21 million cubic meters of natural gas. The Chongqing Steel Company recovered coal gas from its blast furnaces, and then installed automatic regulators this April. Between January and May, the entire company recovered for use an additional 6.775 million cubic meters of coal gas. Throughout this year, the entire province continued to give attention to the spread and use of far infra-red heat, ultra high power electric arc steel smelting, no-load automatic cut-off electric welders, conversion of boilers, firewood and coal saving stoves, low pressure burning of natural gas, and new techniques for the conservation of petroleum products. According to preliminary statistics, the new technology of far ultra-red heat has spread to about 75 percent of the area. The Chonqing Air Compressor Plant used ultra high power electric arc furnaces to smelt steel for a 50 percent saving in electricity. The Zigong Sichuang Glass Plant converted two round kilns into U-shaped kilns, and used excess heat from smoke ducts to pre-heat air for use in production, thereby effecting a 40 percent reduction in consumption of natural gas per ton of melted material.

9432
CSO: 4006

HYDROPOWER CONFERENCE HIGHLIGHTS SMALL HYDROPOWER DEVELOPMENT

Beijing GUANGMING RIBAO in Chinese 21 Oct 80 p 1

[Article by Du Zhanpeng [2629 1455 7720] and Zheng Dexin [6774 1795 9515]: "Second International Small Hydropower Conference Held at Hangzhou. Exchanges of Techniques and Experiences; Promotion of Small Hydropower Construction"]

[Text] The Second Small Hydropower Technical Applications and Development Discussion Meeting of the United Nations' Industrial Development Organization opened in Hangzhou on 20 October.

Technical experts from more than 20 countries participated in the opening of the conference. Most of them came from developing countries, with some coming from developed countries. There were also delegates from industrial development organizations and from other organizations in the United Nations. The main purpose of the conference was to discuss how, in a situation of international energy shortage, to make full use of hydropower resources through accelerated construction of hydropower; to promote an exchange of techniques and of experiences among developing countries in the building and operation of hydropower facilities, and to exchange views on problems of common interest such as the standardization of small hydropower equipment and fabrication techniques. Small hydropower experts from China, which were especially invited to participate in this conference will present for exchange and discussion with foreign experts 10 treatises, including "China's Small Hydropower," "China's Small Hydropower Unit Equipment," and "Comprehensive Development of the Mianjiang Basin."

More than 1500 of China's more than 2000 counties are operating small hydropower stations. They have built 90,000 hydropower stations in which the capacity of the equipment amounts to 6.3 million kilowatts and annually produces 11.9 billion kilowatt hours of electricity amounting to one-third the amount of electricity used in agriculture. Small hydropower has become a major renewable energy source for China's vast rural villages. During the conference, China's water conservancy sector will invite delegates to the conference to an on site visit to Jinhua County and Jinyun County in Zhejiang Province where the building of small hydropower has had substantial accomplishments. The First Ministry of Machine Building will operate an exhibition and sales fair in Hangzhou featuring sets of small hydropower generating equipment.

This conference will be conducted in two parts. The first part to be held in Hangzhou will continue until the 28th of this month, after which the second part will be held in Manila, the capital of the Philippines.

Qian Zhengying [6929 2973 5391], China's minister of Water Conservancy delivered a speech at the opening ceremonies and gave a hearty welcome to the delegates from all nations.

9432
CSO: 4006

SPECIFIC COAL CONSERVATION MEASURES PROPOSED

Beijing RENMIN RIBAO in Chinese 29 Oct 80 p 1

[Article: "Strive To Conserve 4 Million Tons of Coal for the Year. National Conference for the Exchange of Experiences in Conservation of Marketplace Coal Offers Seven Measures for Action"]

[Text] The National Conference for the Exchange of Experiences in the Conservation of Marketplace Coal held in Beijing between 15 and 21 October has proposed the following as main tasks for 1981 in the conservation of marketplace coal: to actively propagandize and unswervingly adhere to state energy plans and programs; ration use of coal resources; vigorous technical changes with conservation as their main purpose; the opening of new ways to gradually solve the problem of fuel for the daily life of rural villages; and supervision of use and supervision of conservation in addition to supervision of the supply of coal in order to improve the quality of service and strive for a saving of 4 million tons for the entire year.

This conference for the exchange of experiences was jointly convened by the Ministry of Commerce, the General Logistics Department of the People's Liberation Army, and the Supplies Bureau. During the conference, delegates heard briefings from 14 units of the Shanghai Municipal Petroleum and Coal Company and watched live demonstrations of coal conservation. The conference also selected 48 advanced units and individuals in the conservation of coal, and gave commendations to 100 units and individuals who had made outstanding accomplishments in the conservation of coal.

Marketplace coal means primarily coal supplied by the Ministry of Commerce for the use of people in the cities and the countryside for use in their daily lives, and for use in small-scale production.

On the basis of the requirements of China's energy resources plans, and experiences everywhere in the conservation of coal, the conference asked that henceforth the following seven actions be taken in the conservation of marketplace coal: 1) vigorous promotion of the burning of molded coal [2052 0992 3561] and honeycomb briquets; 2) continued renovation of coal burning boilers with vigorous promotion of advanced boilers, kilns or ovens and stoves; 3) accelerated test manufacturing and promotion of readily combustible coal cake and coal stoves that will burn it; 4) promotion of experiences in the use of continuous heating and centralized heating; 5) massive use of low quality fuel; 6) the coal that the state currently provides to rural villages is able to satisfy only one-tenth of normal needs, and there is no possibility of future increase. Therefore, diverse ways of solving the problem of fuel for the daily life of rural villages have to be found such as the use of methane, the growing of fuel forests, and the spread of stoves that conserve firewood and coal; 7) management over marketplace coal must be intensified with strict implementation of a system of fixed supply.

9432
CSO: 4006

SICHUAN POWER PLANTS ACHIEVE ENERGY SAVINGS

Chengdu SICHUAN RIBAO in Chinese 20 Nov 80 p 1

[Article by Shi Ren [4258 0432] and Song Jiqu [1345 2478 3255]: "Provincial Electric Power Bureau System Makes Remarkable Achievements in Energy Conservation"]

[Text] The Provincial Electric Power Industry Bureau system has adhered to the rebuilding of facilities technology with energy conservation as the core, has tightened control of economic management, vigorously promoted safety in production, energetically spread experiences in conserving coal and electricity, and has conserved a great amount of energy resources. This year, from January through October, it saved a total of 530,000 tons of standard coal, for a monetary savings of 16.5 million yuan. This included an additional generation of 1.13 billion kwh of hydroelectric power and a reduction in line-loss of 25.63 million kwh and a savings of in-plant electric power consumption of 27.56 million kwh. This was commended at the recently held National Conference for Exchanging Experiences in Energy Conservation.

Where there is high consumption of electric power industry energy, there is a high energy conservation potential to be tapped. This bureau has a total of 19 hydroelectric and thermal electric power plants whose annual coal consumption constitutes approximately 20 percent of coal used by industry provincewide. The electric power used by the electric power industry itself is approximately 15 percent of the total electric power generated. The cost of fuel constitutes approximately 70 percent of the price paid for thermal electric power generation. Because of these factors, they paid attention to linking the expanded authority of enterprises, putting into effect the methods of "unified operations with split management" and "unified accounting with split checking." Coal and electric power conservation was included in the checking of "little quotas," awards were made on the basis of points, and economic responsibility, economic benefits and economic effectiveness were linked, as were state, enterprise and staff and worker benefits, so as to promote a thorough development of energy conservation activities.

In developing energy conservation activities, this bureau paid attention to raising the quality of energy derived from electric power, and assuring safety in production, while at the same time tightening up on economic management throughout the power grid. Through adopting effective measures, this bureau has, since last year, brought to an end situations wherein there were fluctuations between low and high cycle levels. From January through October of this year, the rate at which cycle levels met standards reached 99.95 percent, while breakdowns in electric power generating equipment decreased by 9 percent from those experienced during the same period of the previous year. Additionally, there was an increase in the number of units which achieved safety in production over a long period of time, as exemplified by the Changshou Hydroelectric Power Plant and the Chongqing Electric Power Plant, which achieved periods of safety in production of 521 and 497 days respectively. The chief method for tightening up on economic management throughout the grid was to properly handle hydroelectric and thermal electric power transmission peaks by generating less thermal electric power and more hydroelectric power and by cutting down on coal consumption. Up to the end of October, where identical hydroelectric power generators were installed, and under the conditions imposed by the fact that seasonal flooding was delayed by half a month, hydroelectric power generation surpassed that of the same period of last year by 418 million kwh.

This bureau adhered to rebuilding equipment technology with energy conservation at the core, raised its capability to generate, transmit and transform electric power, and went a step further in conserving energy resources. Since the expansion of authority last year, this bureau has concentrated application of the enterprises' funds in rebuilding technology of equipment in the electric power grid, and has completed a total of 435 renovation or rebuilding projects involving electric power generating or transmitting equipment, restored electric power generating output power totaling 178,000 KW, put into service 128 kilometers of power lines, and increased transformer substation capacity by 600,000 KVA. Among these stations, remodeling and rebuilding projects in the Zigong and Chengdu districts alone accounted for an increase of 200,000 KW of electric power transmission capability, with an extra transmission of 4 million kwh of hydroelectric power each day during the peak water supply period, with a resultant savings in coal consumption of 3,600 tons. The Yuzixi Hydroelectric Power Station completed rebuilding of two generator groups, restoring energy output in the amount of 80,000 KW, and generating an extra volume of electric power totaling more than 100 million kwh from January through October, for a savings in coal consumption of more than 40,000 tons.

This bureau additionally paid attention to strengthening leadership, raising the level of enterprise management, and making great efforts to reduce consumption of coal and electricity. The various electric power generating and supply enterprises throughout the bureau set up similar energy conservation leadership teams and specialist organizations so as to tighten up the control of power lines and fuels. Losses on the electric power lines gradually decreased, and there was a reversal of the trend involving the situation where there had been deficiencies in tonnages and in (consumption/production target figures when) checks were made. The Chongqing Electric Power Supply District halted use of more than 900 no-load transformers for a savings of 430,000 kwh of electric power. Thermal electric power plants carried out a wide-spread promulgation of their advanced experiences in conserving coal and electricity, thereby reducing consumption of coal and electricity. The Chongqing Electric Power Plant achieved remarkable conservation of electricity and coal; heat and electric power plants at Hemenkou, Huayingshan, Jiangyou and Chengdu enjoyed an in-production rate in excess of 96 percent for their high-voltage heaters and saved a great amount of coal. The Jiangyou Electric Power Plant operated 6 high-voltage heaters which were capable of saving more than 10,000 tons of coal annually.

9420
CSO: 4006

BIOGAS:

NEW HOPE FOR RURAL ENERGY SHORTAGE

PLANNERS TURN TO NEW ENERGY SOURCES TO SOLVE RURAL ENERGY SHORTAGE

HK120201 Beijing RENMIN RIBAO in Chinese 6 Aug 80 p 1

[Editorial: "Attach Importance to Rural Energy Construction"]

[Text] Energy construction has now been raised to an important position in economic construction, but at present people only pay attention to energy for industry and fail to attach sufficient importance to energy for rural use. Actually the question of rural energy is also a problem that urgently needs solving.

In the wake of the development of rural production, the increase of rural population, the improvement of rural living standards and ever-growing rural energy consumption, current total energy consumption in rural China amounts to 300 million tons of standard coal a year, nearly 40 percent of total national energy consumption. The 800 million peasants constitute a great energy consumer. The current outstanding problems are that supplies of energy in the rural energy are seriously deficient, while use of energy is extremely irrational. The amount of fuel oil assigned to the rural areas for agricultural motive power this year is only half the figure for the early 1970's; there is a shortfall of about one third in electric power for agricultural use. We should notice that the contradictions are even more prominent in the supply of energy for domestic use, because for many years not enough attention has been given to this point, while the rural population has increased sharply. On average the 170 million rural households are 3 months short of fuel a year, and even if all crop stalks are used for fuel there is still a shortfall. In some places, people have to strip bark off trees, dig out roots or destroy forests. In Sichuan Province over 8 million cubic meters of timber are burned every year, representing half the total amount of timber cut in the province. Since vegetation is damaged, and stalks cannot be returned to the fields, the soil becomes thinner and thinner. This directly affects the development of agriculture, forestry, and animal husbandry.

How is the rural energy problem to be solved? There are two ways, opening up new sources, and practicing economy.

China is relatively rich in rural energy sources such as hydroelectricity, biological energy, solar, wind and geothermal energy and so on, and it is also possible to plant trees for firewood on a large scale and also to open up a number of small coalmines under the state's unified arrangements. However, due to the extensive and great consumption of energy in the rural areas, the many different kinds of energy in use and the scattered nature of the resources, and the very many new resources awaiting exploitation, it is necessary to take effective measures to solve the problems. It is first necessary to carry out a survey of rural natural energy resources. This is an important component part of carrying out agricultural resource survey, zoning and planning work. It is also the prerequisite for making a success of rural energy construction. One item of this work is to thoroughly survey the distribution, reserves and usable amounts of all rural energy resources. Another item is to investigate and analyze the structure, exploitation and use of rural energy, make short-term and long-term forecasts of energy requirements, and make a correct estimate of exploitation, construction and utilization capacity. On this basis we must draw up single-item and comprehensive rural energy zones and put forward plans for orientation, steps, principles and policies in construction work and plans for construction and utilization. This is a fundamental task of strategic significance. The departments concerned must step up cooperation and make a success of it. The next thing is to step up scientific research in rural energy. We must take a positive yet cautious approach regarding some of the results of this research, first setting up pilot projects for demonstration purposes, and then popularizing their experiences.

It is necessary to act in the light of local conditions in rural energy construction and carry out on-the-spot exploitation and utilization of resources. At present we should concentrate on vigorously popularizing methane, actively develop forestry for firewood, and do a good job in running small hydroelectricity stations and coalmines. Developing methane is of extremely great practical significance for solving the fuel problem in the rural areas. Construction and use of methane is attracting ever wider attention. In particular the climate is suitable and the resources abundant in China's southern provinces and regions and in most parts of North China. Many places have already gained successful experiences, which should be taken as the point of emphasis in solving the rural energy problem and vigorously popularized. A rural family with 5 members burns at least 10 kilograms of wood and vegetation a day, and over 1 billion jin thus have to be burned every day in the whole country. If one-half of the rural households used methane, they could effectively use it for 7 or 8 months a year and over 200 million tons of stalks could be returned to the fields to be turned into organic fertilizer. At the same time, places with the right conditions and abundant resources can also build methane power stations, using methane to generate electricity and dry things.

Small hydroelectric stations have the advantages of needing little investment, producing quick results and running at low cost. Vigorously developing such stations constitutes an important way of achieving electrification in the rural areas. The role of the small hydroelectricity stations in many places cannot be taken over by the major power grids. China has now built over 89,000 of these small stations, with a total capacity of 6.3 million kilowatts. They generate over 10 billion kwh a year, accounting for about 40 percent of total rural electric power consumption. Over 720 counties in the country are now mainly relying for power supply on the small hydroelectric stations they have built themselves. However, the small hydroelectric station resources exploited so far only amount to 5 percent of proven resources. There are great potentials and prospects for developing small hydroelectric stations in combination with water conservancy construction.

Developing fuel forests in a planned way is another extremely important aspect. For instance, Yanling County in Henan Province has developed such forests and eliminated its firewood shortage in 3 to 5 years. A number of arid regions in North China and the Loess Plateau in the northwest are limited by natural conditions and find it relatively difficult to build small hydroelectric stations or develop methane; they can plant fuel forests in a big way, as the major way to solve the peasants' firewood problem. Places with the right conditions can distribute some barren hills and hillsides to the peasants for growing fuel forests.

Exploiting small coalmines is also an item of energy construction that makes use of China's resources. A number of communes and brigades throughout the country have already started operating such mines, whose annual output accounts for about one sixth of the country's total coal output; apart from being used by the peasants themselves this coal can also be used to support neighboring towns. There are very great potentials for increasing production in commune and brigade coalmines; so long as we strengthen leadership, make overall arrangements with due consideration for all parties, make rational dispositions, carry out appropriate technical reforms, and also solve the transport problem, there are prospects for a great increase in output within a few years.

Although solar and geothermal energy and wind power are being used on a small scale in the rural areas, such as in solar power stoves and greenhouses, small wind-power generators and other experiments and pilot projects, bringing a rich prospect to rural energy construction, we are still at the stage of scientific research in the economics and technology of their exploitation and use, and cannot yet popularize them on a large scale.

Exploiting energy resources is very important, and so is energy conservation. The current waste of energy in rural China is frightful. Direct burning of crop stalks is a primitive and backward method of energy utilization, since only about 10 percent of the energy can be used. There is also very serious waste in the use of oil and electricity, due to the incompleteness of sets of equipment, irrational structuring, length of transmission circuits, leakages in oil storage facilities and generating equipment, poor management and so on. There are great potentials for improving the utilization rate of concentional energy and saving energy in the agricultural machinery trades and in small chemical fertilizer and iron and steel plants. Excessive use of energy in units producing aid-agriculture products is a universal problem; it is therefore necessary to vigorously carry out technical improvements and strive to increase production while saving energy. We should also organize short training courses and specialized education in institutes of higher education to train able technical specialists to meet the needs of agricultural modernization.

In carrying out rural energy construction, we must seriously implement the relevant policies and criticize and eliminate the pernicious influence of the ultraleftist line in the energy issue. Due to the fact that in previous years some places failed to implement the policy "whoever builds the project owns it, uses it and benefits from it," slow progress was made in building small hydroelectric stations and great losses were incurred. We must formulate policies, regulations and methods that encourage the development of new energy resources in the rural areas, and solve the problems of subsidies, loans, tax exemption, distribution of benefits and so on in energy construction investment. We must mobilize the peasants' enthusiasm, and combine the unified state plans with the masses' activism; we will then be able to achieve faster and better results in rural energy construction.

CSO: 4020

NEW BIOGAS DIGESTERS PROVE EFFECTIVE

OW170738 Beijing XINHUA in English 0728 GMT 17 Aug 80

[Text] Changchun, August 17 (XINHUA)--Cold winter weather used to cause difficulties in producing biogas, a cheap source of energy turned out in the countryside by fermentation of organic waste. Yet 50 biogas digesters, which can produce biogas year round, have been successfully built in Jilin Province, where the temperature falls to 20 degrees below zero centigrade in winter.

The new-type digester was devised by engineers at the Jilin Provincial Agricultural Scientific Research Institute. The concrete digesting unit is built half underground and surrounded by a heat insulating layer. Above ground it is covered with a plastic roofed house. On the coldest days, the temperature inside digesters remains at the 18 degrees above zero centigrade required for fermentation.

A 15-cubic meter digester can produce 0.85 to 1.67 cubic meters of biogas a day, enough to supply cooking gas for a family of five.

CSO: 4020

EXPANDING USE OF BIOLOGICAL RESOURCES CALLED RURAL ENERGY 'REVOLUTION'

Hong Kong CHING-CHI TAO-PAO [ECONOMIC REPORTER] No 30, 30 Jul 80 p 9

[Article by: Liu Xiangqi [0491 4161 7871]: "Expanding the Use of Animal and Plant Resources"]

[Text] The development of methane gas construction in China's vast majority of rural villages in recent years has been very rapid, and China has become the nation in which methane gas is utilized most extensively. According to the statistics of the Ministry of Agriculture, there are more than 7 million methane gas generating ponds in China today, an increase of 14 fold compared with 1975.

There are 17,269 production brigades in 21 counties in China which have basically realized methane gas popularization. Some of the areas have even applied methane gas to the field of production. The scientific research concerning methane gas has progressed from the normal temperature fermentation to medium and high temperature fermentation, and is further moving toward the generalized methane gas utilization. China's methane gas construction has caught the attention of the world. More and more countries are sending their delegates to visit China to learn and to get the technical data concerning methane gas construction. During last year alone, there were many experts representing 43 countries and international organizations who visited China in order to observe and to learn.

Methane gas is a form of energy resource derived from organic matter. Various organic matter, from plant stems and leaves to human and animal wastes, after fermentation, produces a combustible gas consisting mainly of methane. Utilization of methane gas will enable China to tap its second largest energy resource--living things--and utilize it rationally and effectively. This is a revolution in the history of fuel in China's rural villages. The effect of which shall be felt for a long time to come.

China's rural villages used to burn 540 million tons of plant residue each year, equivalent to 310 million tons of standard coal, or more than one-half of the total nationwide mineral energy consumption in 1978. Despite the burning of such a large quantity of energy resource, rural villages are usually short of wood to burn for 3 to 4 months each year. According to calculations, if methane gas is used, just one-half of the plant residue and the human and animal wastes produced in the rural villages will be able to satisfy all the energy needs of rural villages nationwide. Yuhang County, Zhejiang Province used to be short 50,000 dan of wood each year. Since they realized methane gas production in 1978, they have not only satisfied the demand for fuel but also provided 70,000 dan of straw as the raw material for two paper mills. The experts consider that popularization of methane gas is the best way to solve the energy problem of China's rural villages.

Today, threads of cooking smoke can no longer be seen in those areas where methane gas is being used, nor can the odor of human wastes be smelled. Farmers will pick up the animal wastes from the roadside and dump them into the methane gas generating pond so that the number of flies and mosquitos has also decreased. As the human and animal wastes undergo fermentation inside a sealed container, most of the harmful bacteria are killed so that the methane gas generators also have an impact on environmental purification. Utilization of methane gas not only has solved some environmental pollution problems but also has provided the production brigade with a large quantity of high grade mud fertilizer.

Popularization of methane gas in China has a history of 20 years. In recent years, methane gas has not only solved the fuel and illumination problems of rural villages but also, in some areas, provided fuel for electric power generation. Sichuan Province in the southwestern part of China is the area where the development of methane gas is the fastest. There are 5 million methane gas generating ponds, 504 methane gas power stations, with a total power capacity of 5,542 horsepower, and 301 methane gas electric power generating stations with a total generating capacity of 1,494 kilowatts. In addition to these, more new stations are being built today of which the smallest methane gas electric power generating capacity is 3,000 watts and the largest is 120 kilowatts.

These methane gas power stations and electric power generating stations were built and maintained mainly by the production brigades, dairy farms, silkworm farms, and wineries belonging to the communes. The energy thus produced are used mainly for the processing of agricultural byproducts and feeds. They use animal wastes and wine dregs as raw materials for the production of methane gas.

Today, China is strengthening the scientific research work in various fields which are related to the methane gas in one way or another, including microbilogy, thermal energy, chemical engineering, fertilizer, machinery, electric power, and environmental pollution. China is determined to develop methane gas construction into one of the strategic measures of its energy conservation construction work. The government will positively support the rural villages with material and financial powers in their efforts to construct the methane gas system.

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PRODUCTION, USE OF METHANE IN PINGLU COUNTY

Taiyuan SHANXI RIBAO in Chinese 1 Nov 80, p 1

[Text] Pinglu County began methane production in 1972 and achieved preliminary solution of the problems of cooking and illumination in 58 member households, 5 schools and 12 offices and collectives. Their experience in methane work is as follows:

Assuring quality. First they used concrete to build the tanks, which broke down after slightly over a year in some cases and 3-4 months in others, resulting in unjustifiable losses to the masses. Next they used brick and mortar construction for methane tanks with sealed covers, and between 1976 and the present they have built 447 tanks, with gas production rates and successful completion rates both above 98 percent. They sited them rationally, developing them gradually group by group. They avoided blind tank construction and work stoppages and wastage that would have resulted from shortages of funds and materials, and would have resulted in insufficient methane gas and competition between the methane tanks (for materials) and livestock (for fodder).

In implementing policy, they found concrete solutions to the following problems: 1. State subsidies were a secondary source of funds and materials, with the commune members relying primarily on their own resources; they bore 70 percent of the total, the scientific and technical committee 20 percent and the production teams 10 percent. 2. The tank construction area was primarily the commune members' residential area, and in cases where there was no place to build the tanks, the production team planned an area in unified fashion. 3. Overall planning and arrangements for tank construction were done by the commune and production team, and the collective assigned additional workpoints to the builders of the tanks on the basis of their capacity and the amount of work required. 4. In principle the commune members use the methane produced by the tanks and the collective uses the fertilizer. Last year, because the joint production responsibility system was used in the various localities, this problem required further study.

Strengthening technical guidance. In strengthening technical guidance attention was given to the following points: 1. Efficient proportions of materials. Because the materials used in rural methane tanks are complex, the problem of proportions is extremely important. For example, the carbon-to-nitrogen ratio of dried weed stalks is 81 : 1 and that for human excrement and urine is 2.9 : 1. In order to achieve the 30 : 1-25 : 1 ration required for the methane bacteria to survive, the materials must be in the proper proportions. 2. The materials should be composted to the right extent. When the composted materials are brown and do not glisten, composting may cease. In spring the composting time should be 6-9 days, and in winter a bit longer. 3. Only if materials are added and removed conscientiously can enough methane be produced. 4. The pH must be constantly determined, because gas output will be decreased by excessive acidity or alkalinity. 5. Suitable wintering-over measures should be taken. 6. Exterior sections of methane piping should be buried so that they will not be damaged by people or animals and to prevent deterioration. 7. Ovens and lamps should be developed. Sets consisting of pressure gages, tubing, valves, nozzles and ovens or lamps have now been developed.

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METHANE USED TO GENERATE ELECTRICITY IN RURAL VILLAGE

Beijing RENMIN RIBAO in Chinese 10 Nov 80 p 2

[Article by Jia Xingshan [0328 5281 1472]: "Zhen Zijiang Resolves to Produce Methane"]

[Text] Dayu Brigade, Xingtai County, which is deep in the Taihang Mountains in Hebei Province, has just begun to use electricity: not fossil-fuel electricity or hydroelectricity, but methane-produced electricity. Everyone is unstintingly praising young commune member Zhen Zijiang of this brigade. Everybody for miles around knows Zhen, who this year is a little over 30. He has the nickname of "Methane Electricity Fiend." In 1973, when the news of methane production for illumination by Zhongjiang County, Sichuan, appeared in the newspapers, Zhen immediately wrote to Zhongjiang County. A few months later documents on methane production technology written by the Sichuan Province Office of Science and Technology arrived. Zhen was delighted and rushed over with the documents to see the secretary of the brigade's party branch and ask for support. At the same time, he invited Wang Hailin and some other close friends with him and use their spare time to collect stone. Thus began preparations for the first methane tank.

When the county announced a training class on methane production technology, Zhen Zijiang singed up. Unfortunately, owing to persistent autumn rains the long-distance buses stopped running. He wrapped his baggage in plastic sheeting and spent two days walking to Xingtai. After completing the course he brought back a satchel full of documents and notes.

When some of the older people in the village heard that Zhen Zijiang wanted to produce methane they were skeptical, and some said of the methane pit which he built, "After half a year's to-do, he's made a big manure pit." He paid no attention to these people, because he knew that the masses were not unwilling to engage in methane production, they simply did not know about it yet. He needed lime to build the tank; he went to other villages and bought or borrowed it. He had no piping for the gas, so he twice went to Yangquan at his own expense. He also made his own lamps and ovens. Zhen Zijiang decided to put the facts before the masses. When the methane produced by the first methane tank was fed to the brigade office and night school, the people who at first had shown no enthusiasm broke out in smiles.

Last year, when his father, a worker in Shanxi, was about to retire, and they were going to have Zhen Zijiang go to work full time, he wrote a letter to the county science and technology committee saying, "I wish only to continue working on methane; I won't go anywhere." The county decided that they could not spare Zhen Zijiang, but if he didn't go they would lose an opportunity, so they decided to have him first go out as a replacement, then transfer him back to work on methane. Zhen Zijiang persisted: "I won't go."

Zhen Zijiang had another ambition: he wanted to use methane to generate electricity. On the country's 30th anniversary, his long-cherished wish became a reality. The methane produced by 3 tanks was fed to a roaring diesel engine which drove an electrical generator, and the lights of all 140-plus households in the village lit up, as did the street lights. Not long after, stone mills and grinders were replaced by electric ones. Even people from the commune came for "illumination."

Now, with the help of the relevant departments, Zhen Zijiang has drawn up a plan: by the end of this year 80 methane tanks will be built in the village and used to solve production team members' livelihood problems. In addition, 3 neighboring production teams will be involved.

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REASONS FOR METHANE PRODUCTION VARIABILITY DISCUSSED

Beijing GUANGMING RIBAO in Chinese 23 Nov 80 p 2

[Article by Liu Jusheng [0491 5418 3932], Zhenjiang Prefecture Party Committee Office, Jiangsu Province: "What Is the Reason for the Ups and Downs of the Methane Tanks?"]

> [Text] Editors' Note: The problem reflected in this article exists in many localities. It shows that if attention in methane production is given only to the number of tanks constructed and certain specific problems which arise after construction of the tanks are not conscientiously solved, the masses will not reap any benefits, and not only will there be great losses in resources and manpower, but the masses' enthusiasm for methane production may be dampened.
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> Methane production requires certain prerequisites. Different localities' circumstances vary widely, and one single approach cannot be adopted universally. Circumstances must be continually surveyed and investigated, the specific problems in the localities in question solved conscientiously and the work carried forward in a solid manner.

In the last few years, great results have been achieved in extending methane production work in the countryside in Zhenjiang Prefecture. In the areas in which it has been done well, a gratifying picture has emerged in which "food is cooked without using wood or charcoal, lamps are lit without oil or electricity, commune families do not worry about fuel, there is fertilizer for the collective fields, pigs, firewood and foodstuffs are plentiful, and there has been a radical improvement in environmental sanitation."

Recently, however, when I visited Wujin, Yixing and Jintan Counties in this prefecture to investigate the status of methane production, I discovered a good many problems. For example, last year Rulin Commune in Jintan County built 2,067 methane tanks, and 86 production teams were basically converted to methane. But after flourishing for less than a year, methane production again began to decline. This May, the commune inspected 1,750 methane tanks, and only 6.7 percent (117) were able to produce the gas normally, while the other 93.3 percent could not continue in use because of insufficient manure and plant matter, in addition to which some had been abandoned because of a lack of rubber hose, valves and the like, and a few had collapsed because of poor construction.

The main reasons for this state of affairs are as follows:

1. No machinery for removing and transporting the fertilizer, high labor intensity, and ease of damage to tools, negatively affecting the cadres' and commune members' enthusiasm for making a success of methane production. In the past manure was carried from the pigsties at 50-60 jin per pole-load, while now the manure is removed from the tanks at 100 jin a pole-load, and people have to stand several chi deep in the manure in the tank, which is both dirty and wasteful of labor. The commune members use their own manure buckets to carry the fertilizer, and they are very easily broken. They cannot buy the tung oil required to repair the buckets. Moreover, those who enter the tanks are likely to be poisoned, so that commune members are not willing to go into them to remove the fertilizer.

2. No resolution of the contradiction between the production teams' need for fertilizer and the commune members' need for gas. Some production teams do not regularly remove the methane tank fertilizer, and when the fertilizer is needed on the fields they take it all out at once, then do not put in any more material, so that the methane tank cannot produce the gas normally and the methane-using households complain; some production teams consistently fail to organize removal of the fertilizer, then claim that the production team has spent money on methane production and is not getting any fertilizer; some commune members stress methane production and generally do not permit the fertilizer to be removed for the unit, so that the production team's cadres and non-methane-using households are angry at the methane-using households.

3. Lack of scientific knowledge of the use of fertilizer. Methane fertilizer is best applied to plowed, sunned soil or to shallow paddy with a certain quantity of chemical fertilizer, but many communes and production teams apply it to deep-water paddies, so that the fertilizer is lost when the water runs out. Many commune and production team cadres and the masses do not understand this and think that the methane tank fertilizer has a poor fertilizing effect.

4. Failure to implement economic policies dampens the masses' enthusiasm for methane production. Many production teams do not contribute materials, or when commune members contribute the materials they are not compensated, or some irrational "local" policies are worked out with the result that methane-using households suffer economic loss.

5. The county methane offices are poorly organized (some counties even lack them), its personnel are detailed from the various units, and most of them do not give their full attention to the work; the communes and production teams have no people specializing in methane production work.

In addition, there has been a failure to keep up in scientific research in methane, in supplying the raw materials, and in technical leadership, so that there are many problems in these areas.

This year the province has assigned the various localities tasks and targets for the construction of new methane tanks, and the relevant leadership have repeatedly stressed that the tasks must be fully carried out as regards both quality and quantity. Accordingly, we must conscientiously solve the problems described above; if instead people persist in leaving it to their subordinates, problems will multiply without any achievements and it will be impossible to go forward.

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OVER THREE-FOURTHS OF RURAL HOUSEHOLDS IN PANWAN COMMUNE USING METHANE

Beijing RENMIN RIBAO in Chinese 8 Sep 80 p 5

[Article: "More than Three-Quarters of Rural Households in Panwan Commune Begin Using Methane Gas"]

[Text] Panwan commune, Sheyang County, Jiangsu decided to produce methane in the spring of 1978, and in the intervening 2 years the 25 brigades and 8,700 commune households have already begun to operate 6,000 methane tanks, and more than three-quarters of the rural households have begun to use methane. One important reason why Panwan commune has been able to produce methane so rapidly is that the commune and production team cadres did not stop with general slogans but gave the masses solid assistance in solving the real problems of methane production.

Arranging for tank construction materials down to the individual households. Construction of tanks requires more than 10 types of materials including brick, cement and limestone, and for many of them plans had to be issued by the materials departments. To apportion them to every household it was necessary to go from door to door, and even when they had the plans in hand, packaging and transport were also a problem; in order to get started it was necessary to find a boat, hire people and spend money. In order to satisfy the masses' needs for methane production, Panwan Commune arranged for such tank building material as cement, limestone and brick in timely fashion; it was the responsibility of the commune methane office to send down the plans group by group at the proper time, while the brigades made unified provision for transport, hauled the materials to the production teams and distributed them household by household. When some commune members could not pay, the production team paid for them, and were paid back during the year-end distribution.

Work for good quality, stress technology. Before 1978, Panyuan Commune had built 37 methane tanks, most of which leaked water and gas, so that the masses had experienced a great loss of confidence, and some people shook their heads at the mention of methane and said that it was a waste of money and manpower that should not be pursued. The commune and production team cadres learned a profound lesson from this, and afterwards they gave particular care to quality in their methane work; they first repaired the malfunctioning tanks and restored methane tanks' good reputation. Next they held 3 technical instruction classes, training 254 technical personnel, 2 or 3 per brigade. Each production team also had a bricklayer or skilled peasant to take charge of tank construction and management. In the spring of 1979, they inspected the entire commune's methane gas contingent, selected the best 100 persons from among the more than 200 technical personnel and issued them the construction permits which had to be obtained to build a tank. The commune clearly specified the tank construction tasks, the responsibility system and the work compensation to all tank construction personnel. It required that they stay on the job until the tanks were built, until the special kitchens were built and the 5 system components installed, and until the work was accepted. In order to manage the key aspect of quality, all of the brigades set up testing and inspection groups, and the commune printed standard certificates for acceptance in quadruplicate; the household that had the tank built and the technical personnel that built it each kept a copy. The tank construction personnel had their work points and wages calculated by the production team on the basis of these. If the construction was found to be substandard, the technical personnel who had taken charge of construction had to do the work over.

Consciously implement fertilizer policy. Fertilizer is an important form of income for the peasants, and some commune members who raise large numbers of pigs not only fertilize their private plots but also sell fertilizer to the collective, receiving more than 100 yuan for it. When the methane tanks are set up, the commune members' fertilizer income must not be decreased. Following mass discussions, the approach adopted for handling methane tank fertilizer was that when human excrement and urine and pig manure were used for the tanks and the collective removed the fertilizer, the compensation would be calculated according to the guidelines; when the masses used the fertilizer on their private plots, a certain amount of money would be deducted according to the guidelines. When commune members regularly employed their spare time in cutting green material or dredging up water plants for the tanks, or carried prepared stalks and plants to the collective area or brought water to the tanks, the work points were figured within the production team. In this way the masses were satisfied and the methane tanks were well managed.

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SOLUTION TO RURAL ENERGY PROBLEM DISCUSSED

Beijing RENMIN RIBAO in Chinese 27 Oct 80 p 5

[Article by Xu Junzhang [5171 0193 4545] and Huang Zhijie [7806 1807 2638]: "The Way To Solve Rural Energy Problems"]

[Text] The long term inability to satisfy the energy needs of China's rural villages has adversely affected the lives of the broad masses of commune members and has become an obstacle to the development of agricultural production. In the future, as the modernization of agriculture advances, the conflict between supply and demand in energy resources will become more pronounced. What is the way out? This is a major problem awaiting study and solution.

The Serious Rural Village Energy Shortage Cannot Be Ignored

The energy problem in China's modernization has aroused ever more serious attention. But quite a few comrades frequently give serious attention only to industrial and urban energy problems while ignoring energy problems in rural villages. In actual fact, the extent of the shortage of energy in rural villages is even more serious. For example, the number of tractors increases year by year, yet the supply of diesel oil is seriously inadequate. Present supply of oil per horsepower is less than half of what it was 10 years ago. On average, each tractor is able to work only 40 or 50 days a year. Because of the shortage of energy, it has been difficult to spread use of grain drying equipment, so as a result of rainy and overcast weather during harvest time, as many as 10 billion jin is lost each year through mildewing. Despite large scale growth during the past several years in the quantity of electricity used in rural villages to the point where it accounts for 11.5 percent of the quantity of electricity used nationwide, the use of electricity in agriculture remains inadequate. Most peasant households still do not have electric lights, and even if electric lights were to be installed, they would frequently be without electricity supply.

Fuel for daily necessities is particularly lacking in rural villages. Throughout the land, 800 million peasants still basically depend on the burning of firewood and grass to live. Throughout the world today, more than 1 billion people depend on firewood and straw for use as fuel, and China accounts for half of these. But firewood and straw are frequently unable to meet needs as well. It has been estimated that China's annual output of stalks from farm crops amounts to about 450 million tons, of which 30 percent is used as cattle feed, as industrial raw materials, or is directly returned to the fields for use as fertilizer, with only somewhat more than 300 million tons being available for use as fuel. Burning of 10 kilograms per household per day means that this quantity will suffice for only 7 months. In addition to small quantities of coal supplied by the state, another source of fuel for daily life in rural villages is the burning of dry dung and firewood. But even so, the minimum needs cannot be met. Most places in the country lack fuel for daily life for 2 or 3 months each year, and individual places do not have enough for 4 months or more.

In order to solve the firewood problem, each peasant household spends an average of 20 to 30 workdays each year cutting firewood, collecting firewood, cutting grass, or even digging up the roots of grass. Not only does this take a lot of manpower, but, more important, it destroys the ground cover over large areas, and erosion and desertification become increasingly serious. Because of the reckless cutting of timber done by our ancestors, later generations of today have been left with the loess highlands. This is a stern lesson. Currently, the conflict in rural villages among fuel, fodder, and fertilizer, which has grown out of the shortage of energy, has become very sharp, directly impairing the growth of agriculture and improvements in the livelihood of the people. Facing up to and solving the problem of energy for rural villages will brook no delay.

Seeking a Way Suited To China's Circumstances

Development of agriculture throughout the world went through two periods. The first period was the period of handicraft labor in which agricultural production depended principally on manpower, animal power, and natural organic fertilizer. Consumption of mineral energy was extremely slight, and both the productivity rate of farm labor and yields per unit of area were quite low. The second period is the modern agricultural period in which large amounts of farm machines and chemical fertilizers have taken place of manpower, animal power, and natural organic fertilizer, and in which the labor productivity rate and yields per unit of area have vastly increased. But the consumption of mineral energy has also vastly increased. For example, in the United States production of one calory of food required 0.8 calories of energy in 1920, but this had increased to 8.7 calories by 1970 for a 10 fold increase in 50 years.

How to satisfy the every growing needs for energy of modern agriculture has aroused the serious concern of numerous countries throughout the world. In conditions where energy is lacking, in particular, all sorts of ways are being studied.

As a practical matter, China's agriculture cannot use large amounts of petroleum for the growing of food as the countries of Europe and the United States do, but neither can it halt on its existing foundation or at the level of handicraft labor. We must find a proper course to bring about a Chinese-style modernized agriculture.

The population of China's rural villages is vast, and the current level of peasant economic income is very low. The consumption of energy for fuel in daily life consists principally of bioenergy of which annual consumption is the equivalent of 270 million tons of standard coal, or 84 percent of the total 320 million tons of energy consumed in rural villages (not including indirect consumption of energy for production of chemical fertilizer, agricultural chemicals, and farm machines). Along with the modernization of agriculture and improvements in the standards of of living of people in rural villages will come a constant increase in the quantities of energy needed. This situation is different from the one existing in the advanced nations of the world. Their ratio of rural population is very small, and the energy they use is substantially the same as in the cities--electric energy, petroleum manufactures, and gaseous fuels. Stalks and stems from farm crops are directly returned to the fields except for those used as fodder for livestock; they are not used as fuel. In the daily life of the peasants in China, 94 percent of the fuel consists of stalks and stems from crops and firewood; coal supplied by the state amounts to only 6 percent. Were rural people to burn coal as fuel, for the present rural population an additional more than 200 million tons of coal per year would have to be supplied. For the construction of mines, transportation, and processing alone, the state would have to invest several tens of billions of yuan. This would be very difficult to achieve even over a long period of time. Moreover, considering the economic level of China's peasants, for every household to pay from 40 to 50 yuan a year for the purchase of fuel would be a very great burden. Consequently, solution to the problem of energy for rural villages must start with realities as they exist in China, and we have to take our own road to a solution.

In rural villages throughout the land, there is a need to broaden avenues and to use various means to develop energy resources. The adaptation of general methods to specific local situations for the active building of fuel forests will greatly help solve the problem of a shortage of fuel in the daily life of rural villages. In places in which ground cover is scant where there is an urgent need for firewood, in particular, priority must be given the development of fuel forests in a change from the past when the tendency was to give serious attention only to the building of timber forests. Building of fuel forests must be incorporated into national planning for the building of forests.

China has abundant water power resources. In addition to the large rivers for which the state has plans for future development, there are an extremely large number of small hydropower resources that communes and production brigades can develop. As of the end of 1979, small hydropower stations already built by rural villages amounted to more than 90,000, and capacity of their equipment amounted to more than 6 million kilowatts to play an active role in satisfying the needs of rural villages for electricity. In all of China's southern provinces, in particular, a great potential exists for the development of hydropower. Through reliance on commune and brigade forces, the building of projects that combine water conservancy for farmlands with small hydropower stations can provide abundant, low cost electric power for production and daily living in rural villages.

Somewhat more than 1000 counties throughout the country have small coal mines that provide fuel for county, industrial, and commune business enterprises. But reckless digging and mining has to be prevented with attention given to safeguarding resources. In the south, bone coal resources are quite abundant, but since it produces low heat, five tons of bone coal equals only one ton of good coal. When a lot is to be consumed, transportation costs become too great; consequently it can be used only locally. Furthermore, at the present time use of bone coal solely as a fuel is very uneconomical. Only if it is used in multiple ways can fairly good economic benefits be realized.

Rural villages also have to give attention to use of solar energy, to wind energy, to geothermal energy, and such various forms of natural energy. In the process of modernizing agriculture, the old methods of utilization have to be changed and study made of new techniques for their highly efficient utilization, thereby turning to greater use of these energy resources, which have a vast potential.

Development of Methane Is a Strategic Measure for Solution of the Energy Problem in Rural Villages

Direct burning of stalks and stems, firewood, grass and animal dung is a backward way of using energy. This not only wastes energy resources, but also destroys the cycle of matter between the soil and crops, and the fertility of the soil declines with bad consequences for agricultural production. Destruction of the vegetation cover also imbalances the natural ecology. Currently, rural village utilization of bioenergy is only a simple one or two time utilization. For example, the stalks and stems of crops are directly used as fertilizer with the energy fixed in the plant through photosynthesis not being used but completely wasted. If they are directly burned for fuel, only a portion of their energy is used and the utilization rate of heat energy is very low, usually around 10 percent, while the organic matter in the stalks and stems is destroyed, and most of the nitrogen and phosphate nutrients that plants need to grow is dissipated. Return to the field of plant or wood ashes supplements only the potash content of the soil. The traditional use made of animal dung and human feces has been as fertilizer, with quite a large amount of the energy not being utilized.

Development of methane is an advanced method for using energy. It can make use of the various nutrients and energy within plants to derive a quite full and rational use of them. Fermentation in a methane-generating pit of human and animal dung, stalks and stems from crops, green grass, and leaves from trees not only produces methane gas for use as a fuel, but the liquid and sediment in the methane-generating pit also contains an overwhelming portion of the nutrient materials plants need, and is a high quality organic fertilizer. Thus bioenergy resources find multiple use and economic benefits are strikingly increased.

Methane has developed very rapidly in China during the past several years with the construction of more than 6 million methane-generating pits. In terms of numbers, China leads the world. Additionally, a great deal of advance has been made in research into the science and technology of methane for the creation of favorable conditions for the promotion of this advanced method of using this extremely practical bioenergy resource.

Given the present situation in China's agricultural production, sources for the derivation of methane are very abundant. It is estimated that if all available animal and human dung, and the stalks and stems that are used as fuel were to be put into methane-generating pits, 136.5 billion cubic meters of methane could be derived annually. This does not include the gas from weeds and tree leaves accumulated for fertilizer. With such a huge resource, not only could the fuel needs of the entire population of rural villages be satisfied, but the requirements of 5 million methane-powered stations operating 6 hours daily to produce 5000 to 8000 kilowatts could also be satisfied. On the basis of the experience of production teams who have done well in producing methane, only about 3 kilograms of the stalks and stems used as raw materials for fermentation in the methane-generating pits are used in a day per household, which is one-third the amount of firewood directly burned. From this it may be seen that if rural villages universally manufactured methane gas, the shortage of stems and stalks for burning would become a surplus.

Comprehensive use of bioenergy resources to produce methane gas is the first major change in several thousand years in fuel use by rural villages, and it is also the most realistic and most important way of solving the shortage of energy in rural villages. But since 1958 all has not been smooth sailing in the development of methane gas, and there have been several ups and downs. We should conscientiously summarize these experiences to help with future development and consolidation.

First of all, every echelon of leadership must make the development of methane an important matter. This is an important ingredient of China's agricultural modernization, and a strategic measure for solving the problem of energy resources in the rural villages of China. For the development of methane, there positively cannot be any simple summoning of people to action; the matter must be taken firmly in hand and not let go, and gradually promoted in a planned way.

Methane manufacture must be done scientifically. One thing required is enhancement of the study of methane science and technology, continued improvement through practice, and the use of fairly advanced technology to develop methane. Another thing required is vigorous development of the popularization of scientific knowledge about methane to combine the development of methane with increasing the scientific and cultural levels of the people, particularly the broad masses in rural villages.

Of extreme importance in how good a job is done in methane work in rural villages is the formulation of proper policies, of which two hold the key: one is that the funds to make methane cannot be entirely the responsibility of the state; subsidization has to be of an appropriate kind, with the state mostly using its power to provide technology and the materials for building methane-generating pits for the development of methane. Another is that production teams must carry out a sensible fertilizer policy. After they start producing methane, they should not reduce workpoints for the people's nightsoil. Only in this way can commune members' enthusiasm for collecting dung to produce gas be aroused. In addition, specific arrangements have to be worked out regarding use of gas by peasant household and the collective use of nightsoil.

The development of methane requires an overall plan. Every production team in the country has to figure out the financial conditions and natural conditions required to develop methane, making an overall methane plan on the basis of financial and material capabilities. They must proceed according to abilities, develop step by step, and firmly bear in mind the lessons of past rash action. In terms of the entire country, development should start in places where conditions are good and the shortage of fuel for use in daily life is especially urgent. Within individual production teams, forces have to be concentrated for a step by step approach in order to strengthen management.

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CSO: 4006

SICHUAN PROVINCE COMPLETES BUILDING 4.16 MILLION METHANE PITS

Beijing GUANGMING RIBAO in Chinese 10 Aug 80 p 1

[Article: "Major Effort To Resolve Rural Energy Resources Problem Through Use of Methane"]

[Text] The work of popularizing methane in Sichuan Province has made obvious achievements. From 1973 to the beginning of August of this year, Sichuan has built 4.6 million methane pits. One-tenth of the counties, one-sixth of the production brigades and one-fifth of the production teams have basically realized the production of methane.

Energy resources in the rural villages of Sichuan Province are seriously deficient, directly affecting the speed of realizing agricultural modernization throughout the province and improvement of the livelihood of the farmers. What could be done? Their method was to open up sources of energy and to take the development of methane as an important way to solve the problem of energy sources in farm villages. The results were good. For the past 6 years, the yield of methane pits that have already been built and being used is equivalent to a saving of over 1.5 million tons of coal and over 15,000 tons of kerosene for the state. In counties and communes which have realized the production of methane, the situation of a shortage of energy sources has been visibly eased. The farmers no longer burn a lot of dried stalks and trees and wood as firewood. This has greatly stimulated efforts to close hillsides to facilitate afforestation, improve the content of organic matter in the soil, reduce agricultural costs, increase agricultural production and the income of the farmers, and improve environmental sanitation conditions in farmers, and improve environmental sanitation conditions in farm villages. For the past 2 years, over 100 specialists, scholars and government officials from 46 nations have come to Sichuan to inspect and learn the techniques of developing methane.

Methane as a modern scientific technique has not been popularized in our nation for a long time. The work in popularizing methane in Sichuan Province was able to develop so quickly within a short period of 6 years because of one very important reason. A group of leading cadres of localities and cities and counties had a deeper understanding of the importance and urgency of solving the energy sources in farm villages. They saw that the farmers had to work throughout the year to gather fuel and saw the advantages of methane as an inexhaustible biological energy source in rural villages. Through experiments at the localities, they grasped the advantage of developing methane which brings only good and has no disadvantages. Therefore they grasped the work in popularizing methane as enthusiastically as they grasped production. The first secretary of the city committee of the Chinese Communist Party of Mianyang City, Xue Binkui [5641 2430 1145], grasped the basic scientific and technical knowledge of developing methane through hard learning and grasped the city's work in popularizing methane in a big way. Now, 82.6 percent of the rural families of the city's farm villages use methane for cooking and lighting.

The work of popularizing biogas technology in Sichuan Province progressed relatively rapidly because they gradually built up a team including management cadres who possessed a definite scientific and technical knowledge and specialized technical personnel by holding technical training classes on a trial basis. Since 1977, the province, prefectures and counties have trained a total of over 10,000 heads of local and county methane offices, management cadres and technical personnel. After training, some leading cadres no longer say "development of methane can be done by stone cutters and cement workers," an unprofessional comment. Management cadres and technical personnel learned the technical knowledge of mathematics, biology, chemistry and architecture related to methane. This has created conditions for scientific building of methane pits in a popular fashion throughout the province, and better results have been obtained.

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CSO: 4006

EXPANDING USE OF METHANE IN BEIJING SUBURBS

Beijing BEIJING RIBAO in Chinese 9 Jul 80 p 1

[Article by Jin Jinyin (5677 6855 0603) of the Municipal Methane Office: "Suburban Communities Must Actively Expand the Use of Methane"]

[Text] Methane is a kind of biological source of energy that is inexhaustible. Developing methane in farm villages has opened up a new path for solving the fuel problem for daily living. In the Beijing area, a methane pit with an effective capacity of 10 cubic meters--as long as it is managed well--can satisfy the needs of one family for cooking three meals, cooking hog feed and lighting one lamp. Calculating on the basis of using methane for 6 months out of a year, each family can conserve 1 ton of coal or 2 and a half tons of firewood per year. In addition, developing methane has also opened up a new source of organic fertilizer and improved the sanitary conditions of the farm villages.

The city began to develop methane in farm villages beginning in 1975. For the past 5 years, over 24,000 methane pits have been built. Of these, over 14,000 pits, or 50 percent, provide energy for cooking three meals a day 6 months out of the year. Two communes and 129 brigades have already popularized the use of methane and of these 50 brigades have done the work well.

To hasten the development of methane in farm villages by this city, we suggest:

First, strengthen leadership of methane work in farm villages. The cities, counties (wards) and communes should set up corresponding offices or personnel and they should be included in the official budget. The agencies at each level should be clear about their duties and annual plans and long-range plans should be drawn up in time. Materials and funds for developing methane should be included in the state plan.

Second, the policy of quality first must be insisted upon in building methane pits. Efforts should be exerted to build every pit successfully so that the number of disused pits can be decreased.

Third, strengthen management of methane pits and properly handle the conflict between the use of methane by commune members and the use of fertilizers by the production teams. The northern farm villages customarily use farmyard manure while the methane pit is mainly liquid manure with a small amount of sediment. This requires that the tools for producing fertilizer, transporting it and applying it must be renovated by necessity. At the same time, the economic policy of giving points to those who invest in fertilizer production should be drafted, a specialized team to manage methane pits should be set up to carry out unified and scientific management of supplying manure, producing fertilizer and producing compost.

Fourth, scientific research agencies to study methane should be strengthened, funds should be increased, personnel should be provided to take up the scientific research topics of developing methane.

Fifth, methane pits should be concentrated and linked together. These pits should be popularized in expanses in one brigade and one commune. Pits should not be built in a scattered fashion and this idea should be popularized brigade by brigade and commune by commune to avoid dispersion. This will benefit the development and firm establishment of methane.

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SHODDY CONSTRUCTION HAMPERS EARLY EFFORTS TO BUILD METHANE PITS

Beijing RENMING RIBAO in Chinese 30 Jul 80 p 2

[Article: "Developing Methane as an Agricultural Capital Construction Task"]

[Text] The work of popularizing methane in Guangji County, Hubei Province, has been progressing steadily. Up to the end of June of this year, the entire county had built 22,570 methane pits and 8 small methane power stations and installed over 8,500 methane lamps of various types. Twenty-nine brigades and 347 production teams have basically realized the production of methane.

Guangji County began to test develop methane in 1975. At the beginning, the Party organization at each level grasped the work in developing methane as agricultural capital construction tasks. Later, because some practical problems could not be solved, the rate of progress in developing methane slowed. After the Chinese Communist Party's Third Plenum, the leading members of the county committee and nine cadres and technicians of the county methane office went into each commune and brigade to conduct surveys and record the number of methane pits that had been built. The experience and lessons were concretely summarized and they helped to solve the practical problems and to promote the work in popularizing methane.

Guangji County discovered an increase in bad pits and a drop in the use of methane pits through the surveys of each brigade. The main reason was that when constructing the pits, low cost of construction and haste were unilaterally sought at the neglect of the quality of the pits. With the addition of placing emphasis on building and neglecting management, although new pits were continuously being built, the percentage of use dropped year after year. In the face of this situation, they conducted technical training classes in methane at Meichuan Commune to train methane technicians and established specialized teams to repair the bad pits. After half a year, the entire county had organized a total of 54 repair teams and trained 422 technicians who could build, install, manage and repair methane pits, and a total of 3,247 bad pits were repaired. Afterwards, the entire county established over 350 management units and strengthened management of methane.

It was also discovered in the surveys that many communes and brigades that had basically realized the production of methane were caught in the conflict between the use of fertilizers and the use of methane gas, in particular, those places which had built more pits frequently lacked methane raw materials. To solve this conflict, they conducted experiments at the locality at Weiyuan Production Team, Wuli Brigade, Longping Commune and actually grasped the following three aspects: one was the establishment of a five-man special unit mainly from the cattle raising group to collect methane manure and make methane manure year round; the second was to implement the economic policies and mobilize the masses to provide manure; the third was the establishment of a methane management and responsibility system, and methane technicians grasped the scientific input and output of manure. The result of such efforts not only better solved the problem of raw materials for methane but also gathered an additional 240,000 jin of fertilizer for the production team. This experience was quickly popularized throughout the province and realized compatible use of both fertilizer and methane gas.

In large villages where houses are crowded, what should be done when there is no empty land for building pits? They built a "methane colony" on a trial basis at the Huluoyu Brigade, Shifoshi Commune. Ten large and medium sized methane pits were built outside the village and connected by methane pipes which led into the nearby collective mess hall. A generator was connected to the pipe. During the daytime methane was used for cooking and for processing and for lighting during the night. This created a new road for the development of methane in large villages where houses are crowded. Now, there are over 30 such "methane colonies" throughout the county.

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METHANE PRODUCTION BRINGS BETTER LIFE, CLEANER ENVIRONMENT TO VILLAGES

Beijing GUANGMING RIBAO in Chinese 29 Nov 80 p 2

[Article by Zhang Guoguang (1728 0948 0342): "Development of Methane Serves Many Purposes"]

[Text] The Artificial manufacture, extraction and utilization of methane are an important way to solve the problem of inadequate energy resources in rural villages. They are also effective measures to strengthen sanitation construction and agricultural use of fertilizers. The development of methane by the Dongwan Brigade, Xinhua Commune, Hua County, Guangdong Province for the past 3 years is proof of this.

Dongwan Brigade is situated in flat, northern outskirts of Guangzhou. It has six production teams and 320 families--over 1,600 people. This brigade has a total of 2000 mu of paddy fields. In the past, due to a lack of firewood and stalks, few sources of fertilizer and an inadequate labor force the yields of food grains could not be increased and sideline industries could not be developed.

In the autumn of 1976, with the support of the county science committee and the technical guidance of the Guangzhou Energy Resources Institute of the Chinese Academy of Sciences, this brigade began to conduct experiments in the manufacturing, extraction and utilization of methane. After ceaseless efforts--from isolated units to brigade level--the entire brigade basically realized the production of methane by 1978. At present, the entire brigade has 278 methane pits (11 collective pits) and two production teams have built a small methane power station of 19.5 kilowatts of installed capacity. Another small methane power station is being built. Methane pits now serve production as well as household needs. The production and living conditions of the commune members have been improved.

One was the expansion of the sources of fertilizers. In the past, commune members used stalks of crops and straw as firewood. Now, with the methane pits, human and animal wastes, garbage and weeds and peanut sprouts can all be put into the pits for fermentation. Gas is produced as well as fertilizer. Straw is returned to the fields to improve the soil. Because of the increase in fertilizer, agricultural costs have dropped. In 1977, the entire brigade spent over 42,900 yuan to buy fertilizer. In 1978, the amount of money used for buying fertilizer dropped to just over 28,000 yuan. In 1979, it was not necessary to purchase fertilizer.

The second was the opening up of new energy resources. In the past, except for the small amount of straw left as feed for domestic animals each year, most of the straw was distributed to commune members as fuel. But the straw was only enough for burning for a short period. After methane was developed, each family built a pit. This conserved large amounts of wood and straw, and using methane to cook was very convenient. In addition, the electricity generated by the methane power station has been used to thresh grains, crush feed, process food and light homes, supplementing the insufficient electricity supplied by the large power supply network.

The third was the promotion of the development of such sideline production as hog raising. Here, cooked feed is customarily used for hog raising. In the past, because of a lack of wood and stalks and the shortage of labor, the development of hog raising was hampered. After methane was developed, the problem of fuel for cooking hog feed was solved. At the same time, the stalks of some crops could also be kept as feed. This created favorable conditions for the development of the hog raising business. The number of hogs raised by the entire brigade in 1978 showed an increase of 14.9 percent over the previous year. The number of hogs in 1979 showed a further increase of 7 percent over 1978. The more hogs there are the more manure there is. The methane pits thus have more raw materials.

The fourth is the transformation of the conditions of environmental sanitation in the farm villages. Development of methane in farm villages combines "two managements and five changes." Polluted water, manure, garbage, and weeds are all put into the methane pits for fermentation to produce gas. This improves environmental sanitation and also reduces the propagation of mosquitos and flies and the households of commune members are much cleaner.

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PILOT BIOGAS POWER STATION UNDERGOES INITIAL TESTS

Guangzhou NANFANG RIBAO in Chinese, 6 Jul 80 p 1

[Article by Zhang Lizi (1728 5408 1311):" Opening New Way for the Utilization of Biological Energy Resources"]

[Text] Our province's relatively large methane power station--the Liede Methane power station in the eastern suburbs of Guangzhou--has completed its first phase of construction and generated power on a test basis yesterday. It will play an active role in cleansing the environment and exploring the uses of biological energy resources. Yesterday afternoon, leading comrades of the Guangzhou municipal committee Yang Shangkun [2799 1424 2492] and Xiao Ming [5135 7686] inspected the test run and were briefed on the situation.

This methane power station is a research project assigned by the State Scientific and Technological Commission, sponsored by the Guangzhou Municipal Science Committee, and carried out under the cooperation and coordination of the municipal environmental sanitation department, the municipal energy resource center, the municipal survey and testing department and concerned units of Dongshan Ward. The station was constructed by expanding and utilizing the original Liede manure and fertilizer wharf. It utilizes the garbage and sewage of Guangzhou to generate power and the waste water of nearby factories to generate methane. It has a total of 6,000 cubic meters of cesspools, Installed capacity is 500 kilowatts and the maximum unit capacity is 120 kilowatts. During the course of construction, concerned engineering and technical personnel conducted experimental studies of installation, fermentation, purification and mixing for generation of power by methane. They rebuilt two 84-kilowatt diesel generator systems to use only methane for power. Experiments show that human waste can be rendered harmless after high temperature fermentation and will have a higher fertilizing effect for agricultural crops.

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LACK OF UNIFIED MANAGEMENT FOILS GUANGXI METHANE PRODUCTION EFFORT

Beijing RENMIN RIBAO in Chinese, 8 Sep 80 p 5

[Article by Staff Reporter Liu Xingxe (0491 2502 3419): "Why Has Gunagxi Been Slow To Expand Use of Methane?"]

[Text] Developing methane in a big way is a major project that affects construction of energy resources in farm villages, construction of sources of fertilizers, environmental protection and construction of sanitation projects. It is an important part of the construction of agricultural modernization. The Guangxi Zhuang Autonomous Region is situated in the Subtropical Zone. The resources of methane are rich and the region has superior conditions for developing methane. To support the masses in developing methane, the state has allocated massive amounts of funds and material each year.

But during the last few years, the development of methane in Guangxi has been slow. According to statistics, since 1971, when the popularization of methane began, only some 40,000 methane pits have been built throughout the region, ranking it 15th among all the provinces, cities and autonomous regions throughout the nation.

Since popularization of methane in Guangxi, concerned leading agencies have not given sufficient attention to this work. They believed there were many problems in developing methane and were not willing to grasp the work. The management agencies also underwent very frequent turnovers. Before 1974, the work to develop methane throughout the region was under the centralized control of the Science and Technology Bureau. In 1975, the autonomous region decided to assign the work of developing methane to the planning department. As soon as the planning department took over, in 1976, it was decided that the work was to be handed over to the agricultural office. As soon as the agricultural office took over, it was immediately decided that the work was to be handed over to the agricultural bureau. Then, in 1979, it was decided that the work was to be handed over to the soil fertilization station of the agricultural bureau. Because of the frequent change from the top to the lower level management agencies, the workers and personnel frequently changed and management work could not be carried out. Some localities have management units in name only but actually nobody manages the work. The masses wanted to develop methane but they could not find the managing unit or managing personnel. Since last year, according to related directives from the Central Committee, the autonomous regions planned to assign 8 to 10 specialized cadres to the soil fertilization station of the agricultural bureaus of the regions to grasp methane development. Now, there is only one person actually in charge of the work. It was stipulated that each locality, city and county assign 1 to 2 specialized cadres to grasp methane development. Some localities even now do not have even one specialized cadre. Luzai County is a key county in the Liuzhou area designated for developing methane. In 1980, the state allocated 120,000 yuan for construction of methane pits (including construction of lavatories, pig pens and cow sheds, and secreted waste storage sheds), 1,500 tons of cement, and asked the locality to construct 1,500 methane pits. Because there was nobody to manage the work, up to today, the county has not constructed any methane pits.

Under a situation in which the management agencies change hands frequently, the work in training a technical force cannot keep up. The result is that the design of the pits at many localities is irrational, materials for construction are not in proper proportion, and a large number of "sick pits" that cannot be used are built. Some other localities did not implement the economic policy and this also affected the enthusiasm of the commune members in developing methane. For example, at the Fourth Production Team, Liangtong Brigade, Chengxiang Commune, Xuming County, originally there were 15 commune member families that had constructed methane pits and every one was a success. But the production team did not give the commune members supplies. The commune members wanted to provide their own materials but the brigade did not record their work points for fertilizer.

1. The leading agencies of the autonomous regions should include in their agenda the work of strengthening the leadership in the work of developing methane. In actual work, the problems of the managing agencies and managing personnel must first be solved. From the autonomous region to each locality, county and city, a specialized management agency in charge of developing methane should be established. Each locality, county and city should assign one Party and political leading cadre to be in charge of grasping this work well, and the departments of industry, transportation, health and finance and commerce must be actively organized for support and cooperation. The management agencies of every level must assign personnel to that work.

2. One of the greatest hindrances to the development of methane in farm villages at present is the poor techniques in building methane pits and there is a serious deficiency of technical talent for developing methane. At localities where the conditions for developing methane are good, a special team for developing methane should be established. Personnel participating in the team must first undergo a definite period of technical training and in the course of building the methane pits, the masses should dig the pits and prepare the materials and the specialized teams should take up the construction. After the pits have been built, and after they have been inspected and considered to have met the standards, the production teams of the commune members should be given a corresponding reward. The pits that do not meet the requirements should be rebuilt, deductions from salary should be made, or rewards should be withdrawn.

3. It is hoped that the autonomous regions can as quickly as possible establish a set of management rules for methane and a series of related policies to change the present situation of developing methane without any precedent to follow.

4. Scientific research work related to methane has been done relatively poorly in Guangxi. Up to now, the entire region does not have a specialized methane research unit or personnel. They hope the autonomous region would organize those persons who have some experience in methane work to carry out methane research to solve some actual problems in the development of methane.

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DEVELOPMENT OF METHANE SEEN AS ADJUNCT TO AGRICULTURAL MODERNIZATION

Chengdu SICHUAN RIBAO in Chinese, 12 Aug 80 p 1

[Article: "Accelerating Methane Projects With Stronger Leadership and Higher Quality"]

> [Excerpts] The Provincial Methane Work Conference has passed on and learned from the requirements of Comrade Deng Xiaoping Concerning Methane Work; deeper understanding was gained, experiences summarized and developmental plans drafted. Comrade Yang Chao [2799 6389] attended in the conference and spoke at same.

Gaining a deeper understanding summarizing experience, planning well, accelerating the methane projects with high quality were the central topics of the Sichuan Provincial Methane Work Conference. This conference was held from 1-7 August in Guanxian. Secretary of the provincial committee Comrade Yang Chao [2799 6389] spoke at the conference.

The conference passed on and learned from the requirements made by Comrade Deng Xiaoping concerned methane work when he came to Sichuan on an inspection tour. Everyone engaged in an enthusiastic discussion of how to accelerate the building of methane projects in our province. Everyone further understood that developing methane is the direction to solve the energy sources in farm villages and it has manifested its great role in the building of resources of fertilizer and health projects. It is a strategic measure to hasten agricultural modernization. The conference asked the leadership of each level to grasp methane work as a major task to solve the energy sources in farm villages, strengthen leadership, solve the problems of capital, material, techniques and management so that construction of methane projects can actively move forward in a steady manner.

Comrades at the conference reviewed the course of development of methane in our province. Under the leadership of the Party committee of each level, our province's methane projects have developed greatly. Methane has exerted visible impact in solving the fuel problem in farm villages, promoting agricultural production and improving environmental sanitation. The development of methane by the tens of millions of the masses has accumulated rich experience and this experience has become the precious wealth for hastening the development of methane. At the conference, the experiences of each locality in carrying out the methane projects were fully exchanged. These experiences all show: Large-scale participation in methane projects requires full mobilization of the masses and a serious scientific attitude to unify the need with the possibility, quantity and quality, construction of pits and management.

The responsible comrades of the Guanxian county committee introduced to the conference their experience of suiting measures to local circumstances. Delegates to the conference also visited the two methane project sites carried out by the masses at Jiahong Commune and Qinglong Commune in Guanxian County. Every pit built is a successful one. Construction of methane projects seems to be slow but is actually fast. Their experience is worth learning from. The responsible comrades of the Wenjiang area methane projects introduced to the conference the plan to basically provide methane to local communes and brigades that will lack sufficient logs for firewood by 1982. The characteristics of their plan are: fully realizing the activeness of the masses in engaging in methane projects and taking practical considerations of the objective conditions of material supply, techniques and capital so that the plan is vigorous and reliable. Representatives from Chongqing City, Nanchong City, and Mianyang City's Yongxing Ward also introduced their experiences in suiting measures to local circumstances, drafting plans, building pits and management work.

Comrades attending the conference gained a deeper understanding, learned from experience, and drafted plans to hasten the development of methane. Everyone thought the present situation is good--even better than before--for developing methane in farm villages. A technical team for construction of methane projects is currently being organized, and repair and construction of methane pits are starting to be standardized, serialized and generalized. The enthusiasm of the masses to engage in methane projects is becoming greater and greater. As long as the ideological line and the method of work are correct, fully utilizing these advantageous conditions will surely hasten our province's construction of methane projects and fully develop the role of methane in realizing agricultural modernization.

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SOLAR POWER:

LONG-TERM
DEVELOPMENTAL PROSPECTS
RECOGNIZED

PLACE OF SOLAR ENERGY IN NATIONAL ENERGY POLICY REVIEWED

Beijing TAIYANG NENG [SOLAR ENERGY] in Chinese No 2, 1980 pp 1-2

[Article by Gu Jian [7357 1017]: "Solar Energy Utilization and Energy Policy"]

[Text] Man has been making use of solar energy for a long time (for example, evaporation of salt water, sunning grain and the like). Accordingly, in this sense the use of solar energy is nothing new. But making solar energy a major energy source to provide man with hot water to heat or air condition dwellings, to cook food in solar ovens, to provide the heat energy required by industrial and agricultural production, to generate electricity and the like, is something new; and it is on the basis of modern science and technology that these uses have begun to develop.

Accordingly, at present when we speak of the utilization of solar energy we mean using it as an energy source to replace such conventional energy sources as coal, electricity, petroleum and natural gas.

For the state to direct energy development and utilization it must develop an energy policy, as part of which it must forecast national energy requirements and the structure of the prospective energy supply, investigate developmental trends in energy technology and so on. The overall objective is to achieve a balance between energy supply and demand so as to assure development of the national economy and improvement of the national standard of living, while achieving the goals of protecting the environment and using energy economically and efficiently.

Since 1973 there has been an energy crisis in the Western world, in which oil supplies have been insufficient and oil prices have risen rapidly, and the economic development of the countries which rely on imported oil as their main source of energy source has been particularly affected. Accordingly, many countries, such as the United States, West Germany, Japan and France, have drawn up energy policies on the basis of their particular circumstances. For example, the preeminent goal of United States energy policy is to decrease reliance on imported oil so as to assure national security. Clearly, in order to decrease oil imports it is necessary to increase domestic oil production, but a country's oil output is limited by natural conditions. The United States has admitted that its oil output has already passed its peak, and that it is not possible to increase it greatly.

What is the way out? The only recourse is to develop other energy sources which can replace petroleum. The various technical and economic measures and policy measures adopted for this purpose are called an "alternative energy strategy." In addition to coal and nuclear power, the use of solar energy occupies a primary place in the alternative energy strategy. However, the term 'solar energy' is used in the United States in a broad sense, including not only solar energy proper but many types of energy derived from it such as water power, wind power, ocean power, biomass power and the like.

The development of solar energy has not only current significance but long-term developmental prospects as well. By the next century it is very likely that solar power will be one of the main energy sources. However, current solar energy utilization technology is far from being completely ready; it must undergo prolonged, arduous scientific research and developmental demonstration before it can be economically be put into broad use, and accordingly a long period of technological preparation is necessary. United States energy policy includes the objective that the development of solar energy utilization technology must ensure that if the oil supply should become restricted or even be cut off, solar energy together with coal and nuclear power can alleviate the pressure on economic development and the people's livelihood resulting from the oil shortage.

But should the development and utilization of solar energy occupy such a place in a national energy policy? This must be determined on the basis of each country's specific circumstances. There are two extreme views on this question.

One extreme view is that solar power equipment uses excessive quantities of materials and requires excessive investments, is intermittent in nature, being affected by seasonal and weather changes, and is inconvenient to use, on which account it should not be included among the main types of energy development.

The other viewpoint is that since solar energy is an inexhaustible energy source, since it enables energy to be used on a decentralized basis without the need for the excessive centralization currently found in large power networks, centralized heat supply and the like, since its use does not pollute the environment and makes an excellent contribution to environmental protection, and since in addition solar technology is essentially mature, it should immediately be put into use on a large scale.

At present both of these views are somewhat one-sided. In reality, the energy policies which many countries have developed on the basis of their own technical and economic circumstances have affirmed the use of solar power. In addition they point out that at present many solar technologies already are economically competitive and should be used extensively, while many other technologies are still immature or uneconomical, still require much scientific research and cannot yet be used on a large scale. This approach to the utilization of solar energy is relatively objective.

United States energy policy and planning agencies [illegible] regarding the [illegible] which solar energy can be able to supply the United States in the year 2000, and make estimates based on [illegible]. [illegible] be called the lowest estimate, namely that by the year 2000 solar energy will be able to supply energy equivalent to roughly 18 million tons of petroleum (amounting to about 6 percent of the total current U.S. oil consumption). [illegible] probably the maximum actually attainable case, that of solar energy equivalent to 130 million tons of oil a year (about 16 percent of the annual U.S. oil consumption). The third case takes account only of technical constraints and not of economic factors, estimating that solar power can provide the energy equivalent of 210 million tons of oil a year (amounting to about 26 percent of current U.S. petroleum consumption).

The United States has placed great hopes in the use of solar power and has made a great investment in it, with the research and development investment in fiscal year 1979 amounting to 705 million dollars and a figure of 1.16 billion dollars forecast for 1980. In order to expand the use of solar energy, United States energy policy and energy bills have provided for state investment, the drawing up of solar energy research plans and such economic measures as tax incentives.

Our country has given rather serious attention to the use of solar power since the 1970's. In 1979, the Second National Experience Exchange Conference on the Use of Solar Energy was held in Xi'an, along with an exhibition. This conference made it clear that our country has made rapid advances in the use of solar energy. It is already apparent that the trend in this country's solar energy utilization during the near term stresses the solution of rural energy problems. The widespread utilization of solar ovens should be subsidized and encouraged by local governments. Such cities as Beijing and Shanghai, where solar water heating equipment is already in rather widespread use, should continue planned expansion of its use. In order to encourage and stimulate the use of solar energy, our country has also developed a solar energy utilization research plan. Although it is on a small scale, the range of research topics which can be utilized in the near and mid-term, such as solar ovens, water heaters, passive solar houses, driers and the like, is relatively complete. The plan also includes a requirement to pursue long-term research topics such as solar thermal power generation, photovoltaic power generation and solar photochemical conversion. These should all be reflected in the energy policy.

In order to be able to use solar power facilities for extended periods and to diminish or eliminate solar power's weakness, its intermittent character, research on energy storage technology should be pursued and allowance made for combined utilization of multiple energy sources, including such types of combined heat or power production as solar energy and methane, solar power and wind power, solar power and small hydroelectric stations, and solar power and waste heat recovery. Although these forms are currently in the experimental stage, they may well be meriting development.

In formulating an energy policy, the technical and economic nature of solar power use must be given attention. Special attention is given to technical and economic evaluation of the use of solar power abroad. For example, in United States energy planning, different kinds of encouragement are given to technologies which are at different developmental stages, and solar technology is divided into three categories. The first is technology which already is or soon will be competitive, such as passive solar [illegible], solar water heaters and the use of solar power in industrial and agricultural production processes. The second is technology which has clear potential but cannot yet go on the market, such as some active types of solar heating. The third category is technology with evident long-term potential which cannot yet be utilized economically, such as solar air conditioning, photovoltaic power generation, and solar thermal power. The fourth category is long-term choices such as satellite solar power stations and solar photochemical conversion. Changes may of course be made in this categorization as technology progresses.

It is only on the basis of technical and economic evaluation that it is possible to direct scienfitic planning so as to adopt policy measures which encourage broader use. Accordingly, energy policy will provide stimulation, support and guidance for the development of solar energy utilization.

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FIRST EXPERIMENTAL SOLAR-HEATED BUILDING DESCRIBED

Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 12, Dec 80 pp 1-3

[Article by Zhang Weishan [1728 4850 6365], Qinghai Province Construction Survey and Design Institute: "Our Country's First Experimental Solar-Heated Building"]

[Text] At the very end of May 4 Street in Xining City is a recently-built 3-story mixed-construction office building. It contains 20 rooms which can be heated without a conventional hot air system in the winter, because they are heated by solar energy. This is our country's first experimental solar-heated building. It has two systems, solar hot air and solar hot water heating. In the winter and spring of 1978-1979 the hot air system was used, and the inspection concluded that its design was reasonable, that all of its characteristics met design requirements, and that it was of great signficiance for conserving fuel and decreasing pollution, and could be put into use.

The Collector's "Greenhouse Effect"

Xining is located at north latitude 36°35' at an altitude of 2,261 meters. It is a plateau city which gets 2,748 hours of sunlight yearly. The percentage of sunlight in winter is 71 percent, and the average total solar radiation in January is 2,657 kcal/m² on a horizontal surface, 3,700 kcal/m² on a vertical south-facing surface, and 4,200 kcal/m² on a surface inclined 50° from the vertical towards the south. These figures provide a reliable basis for solar heating experiments. The plateau's sunny winter weather provides excellent conditions for solar heating.

Atop the heated building is a solar collector system with a double-layer of glass which receives the solar energy. It has been determined that when solar radiation strikes a 3-mm-thick flat piece of glass perpendicularly, 80 percent is transmitted, 8 percent is reflected and 12 percent is absorbed. After visible light passes through the glass it strikes a collector plate made of thin sheet iron, and when the collector plate is warmed by the sun, the solar energy which it has received is turned into heat, which warms the surrounding air by heat transfer. As we know, the wavelength of visible light is between 400 and 760 nanometers, while infrared is between 800 and 100,000 nanometers (1 millimeter is a million nanometers). As we have seen, the vast majority of the solar radiation can pass through the glass, but infrared light with a wavelength longer than 3 micrometers is not transmitted. Accordingly, the energy emitted by the collector plate in the form of infrared rays passes through the surrounding air to the glass, it is "blocked" by the glass. From this it can be seen that the glass in the collector acts as a "one-way valve" for energy: it only permits the solar radiation to enter but does not prevent heat energy (infrared) radiation to escape. This is the so-called "greenhouse effect."

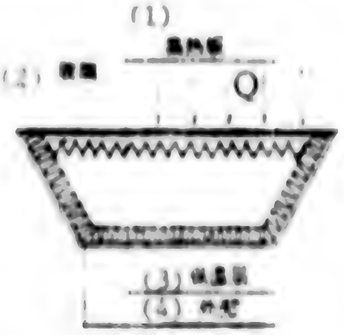

Figure 1. Flat-plate Collector: Cross-section

Key:

(1)	Collector plate	(3)	Insulation
(2)	Glass	(4)	Case

The collector plate is pleated thin sheet iron with its external surface coated with copper oxide, which has relatively high absorptivity and relatively low emissivity, so that as little as possible of the heat energy is radiated away. At what angle does the collector plate receive the most solar energy? As mentioned above, Xining is located at north latitude 36° 35', and when the sun is directly above the equator in the spring and fall the angle which the solar radiation makes with the ground surface at noon in Xining is 53° 25' (90° - 36° 35'); while at noon on the winter solstice when the sunlight is shining vertically on the Tropic of Capricorn, the angle which the solar radiation makes with the ground surface at noon in Xining is 29° 58' (53° 25' - 23° 29'). In order to maximize reception of the solar radiation, the collector plate should be normal to it. Accordingly it should be at an angle of 60° 02' (90° - 29° 58') to the ground. But the coldest time of year is not at the winter solstice but after it, and accordingly we take the time not when the sun is above the Tropic of Capricorn but rather when it is shining vertically on south latitude 15°. Accordingly, the collector angle should be 52° 35' (36° 35' + 15°), for which we can use 50°.

A Heat "Reservoir"

There is a total of 40 square meters of collector atop the [illegible] building, and after the sunlight which it has received is converted into heat energy, it is necessary first to minimize heat losses and second to store the heat energy. We start by installing an insulating layer on the equipment and piping in order to decrease losses of thermal energy. The insulation of the rooftop collector has two parts: the double layer of glass and an interior insulating layer.

Since the "greenhouse effect" described above causes the temperature inside the collector to be much higher than that of the surroundings, can the heat energy inside "escape" to the much cooler surroundings in other forms? It can. Is there a way of stopping these losses? No, but we can decrease them as much as possible.

There is a saying in the north that "10 layers of cloth is not as good as 1 layer of cotton [wadding]," which is to say that 10 layers of unpadded clothing is not as good as 1 layer of padded clothing in the winter. This is because even though both cotton cloth and cotton wadding are poor conductors of heat, the wadding in padded clothing is fluffed up and can hold a large amount of air. Air is also a poor conductor of heat and can greatly decrease dissipation of body heat. The air between the two layers of glass has an insulating effect, as does the air in the cotton wadding. Accordingly, the double glazing is like "transparent padded clothing" for the collector.

The collector cavity is covered on three sides by an insulator, made of cork sheet (cork layer from the oriental oak), which is protected by a sheet iron exterior. The cork is a very good insulating material with a conductivity of only 0.06, slightly higher than that of construction blanket insulation (0.05), and not only much lower than that of the metal structural steel (50.0), but also much lower than that of sodium glass (0.65) and wood (0.10).

On in winter days, when the heat in the collector is not being used for heating, the temperature can climb above 120°C. Measurements indicate that the net heat energy collected by the collector is 1,360 kcal/m²-day, and accordingly it is necessary to devise a way of storing the heat energy. Below the collector plate is a cavity through which the heat medium (air) flows; when the air flows through at a specific speed, the collected heat is carried away through the collector plate to a storage unit which can store the heat.

The storage unit is the "storehouse" for the thermal energy. It is a rock bed 2 m in diameter filled with pebbles. When the air that has passed through the collector is forced by a blower through the storage unit, it gives up the heat it carries to the pebbles, then returns to the collector to cool the plate. This process cycle goes on continuously, constantly transferring the heat which has been converted from the light energy collected by the collector to the storage unit.

The main reason that pebbles are used as a storage material is that they are easy to obtain and cheap. It is not necessary to prevent them from freezing in the winter. They are also [illegible], but since their specific heat is small, a large quantity must be used.

The walls of the rooms to be heated contain several air passages which are connected to the storage unit on the roof by sheet iron conduits. When the room temperature is lower than the value specified (15°C) in this system, the blower begins to operate automatically, sending the heat from the rock storage unit out the room to warm it. Because this system is driven by a blower, it is called an "active" system abroad. It is automatically controlled by a mercury contact thermostat.

In addition to the active system, we also devoted attention to heat collection and storage by the experimental building itself: we increased the area of the south-facing windows in the rooms to be heated (to 6 square meters), decreased the size of cracks around the windows, and installed thermopane glass in the windows. In this way the window itself is a small collector. It is calculated that every window can collect 6,943 kcal of heat energy a day. In addition to the windows, the rooms' reinforced concrete panels and interior walls are excellent heat storage materials. They store up heat energy during the day and release it into the air of the room at night.

Because Xining is at a high altitude and its summer temperature is not high, most of the windows act as "dead windows": they have insulating shutters on their inner sides that can be closed at night. The exterior walls have been made hollow and are filled with insulating material. This combination of measures can decrease heat losses by about 40 percent, greatly decreasing the load on the heating system and lessening the equipment investment on the solar system.

Excellent Heating Results

The warm air heating system of the solar-heated experimental building was designed in 1974 and completed in 1978. The Qinghai Province Scientific and Technical Committee organized the relevant parties to test the system's characteristics. According to design requirements, the average inside temperature of the building was to be 14°C, the amount of solar heat supplied was to be over 50 percent of the total, and the ratio of collector surface to the area of the building to be heated was to be better than 1/3. The tests indicated that all of these design characteristics were met. Between 15 January and 2 February the average outdoor temperature was -8.2°C; the average indoor temperature inside the heated rooms was 14.2°C, while the average temperature in the rooms without the heating apparatus was -0.68°C.

In order to determine what percentage of the heat supplied was solar, we installed in an ordinary [nonsolar heated] room two 1-kW electric heaters, a mercury contact thermostat and a 6401 electronic relay to keep the temperature the same as in the solar-heated rooms; a watthour meter was used to record electrical consumption. The results showed that the proportion of heat supplied by the sun was as high as 80 percent, while the ratio of the collector area to the building area was 1/3:5.

The statistics indicated that the extra investment in the solar heating as compared with an ordinary heating system could be recovered in 3.5 to 9.8 years.

Some may ask what can be done on cloudy days or at night if one has solar heating. This is indeed a problem. This system's storage unit and a series of facilities aimed at decreasing heat losses solved the problem of providing heat at night. Because the system could not be made very large, it stored enough energy for less than a day. Currently, small-volume heat storage facilities are being

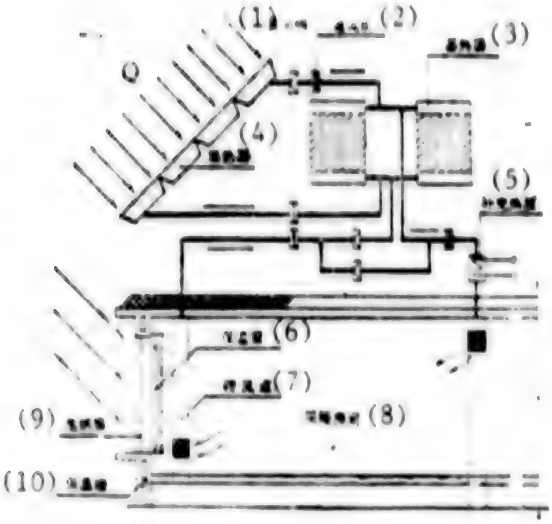

Figure 2. Heating System of Experimental Solar-Heated House

Key:

(1) Automatic valve
(2) Blower
(3) Heat storage
(4) Collector
(5) Supplementary heat source
(6) Insulating glass
(7) Masonry air passage
(8) Heated room
(9) Collector window
(10) Insulated wall

studied in this country and abroad. But no matter what storage method is used, it is uneconomical to use 100 percent solar heating; a supplementary energy source must be used to make up for the shortfall of solar heating. Accordingly, solar heating will not replace all conventional types of heating.

Because heating and air conditioning of buildings consume large amounts of fuel, many countries are currently pursuing research on solar heating and have obtained a variety of practically significant results. The United States plans to use solar heating in 2.5 million dwellings and other buildings by 1985. Many departments in this country are also carrying out this type of research. We believe that in the future this "clean" energy source will be used for heating in more buildings.

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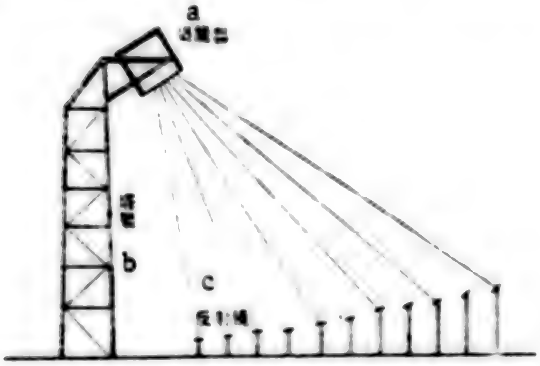
EXPERIMENTAL TOWER-TYPE SOLAR POWER INSTALLATION DESCRIBED

Beijing TAIYANG NENG [SOLAR ENERGY] in Chinese No 2, 1980 pp 17-19

[Article by Zhang Qi [1728 0796]: "Experimental Tower-Type Solar Thermal Electric Power Station"]

[Excerpt] Tianjin University began plans to build an experimental tower-type electric power generation unit in 1977. On the basis of current conditions, it plans to construct a small experimental system to enable it to pursue various types of experimental work rather flexibly and to achieve its two objectives of conducting basic research and saving funds and manpower. Accordingly, a one-sided mirror field will be used, with a total of more than 200 small planar reflectors, each having an area of 0.2 square meters. The reflector field is 8 meters long and 16 meters wide and the top of the tower is 4.6 meters higher than the reflector field surface. The mirrors are divided into 4 groups, each of which is driven by a 2 kg-meter step motor and tracks the sun from morning to evening. Because single-axis tracking is used, as the seasons change the angle of the elevation of the mirrors must be adjusted manually. The concentrator is a cavity into which light is admitted on one side. It has a window area of 0.3 square meters and is inclined downward at an angle of 30°, making it possible to decrease the height of the tower.



Key:
- a. Concentrator
- b. Tower
- c. Reflectors

It is planned to use water as the medium in the thermal electric power system, producing steam at about 250° C and 20 atmospheres. The heat storage system has not yet been installed. Heat power tests are currently under way, and when conditions permit electric power tests will be made. The figure on the following page shows the tower, concentrator and reflector field of Tianjing University's experimental tower-type electrical generation unit.

Tianjin University's Experimental Tower-Type Electrical Generating Unit (tower and concentrator)

The tower-type generator is currently in the research stage, and in particular its problems of energy storage and high investment are still awaiting solution. But its advantages, namely producing electric power without fuel and causing no pollution, cannot be matched by conventional electric power generation.

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RESEARCH PROBES USES OF THIN-FILM CADMIUM SULFIDE SOLAR CELLS

Beijing TAIYANG NENG [SOLAR ENERGY] in Chinese No 2, 1980 p 20

[Article by Zhang Ruifeng [1728 3843 1496]: "Paper-Thin Solar Cells"]

[Text] The dry cell is a familiar type of chemical battery which converts chemical energy directly into electrical energy. But the solar cell is a physical cell, a semiconductor device which converts light energy directly into electrical energy. To date, the world's thinnest solar cell is the thin-film cadmium sulfide solar cell, which is only several tens of micrometers thick, even thinner than a photograph. If it is glued to the case of a transistor radio, connected to it with a wire and illuminated, the radio will play. The thin-film cadmium sulfide solar cell has the advantages of large area, light weight, high relative power, good flexibility, simplicity of manufacture, low price and long life, and in the last few years it has attracted interest throughout the world. Several scientific research organizations, schools and factories in this country have also carried out rather thorough investigations of its operating principles, product manufacturing process, stability and utilization.

The basic structure of the thin-film cadmium sulfide cell is shown in Fig. 1 [not reproduced]. It consists of a metal or metallized plastic plate, a cadmium sulfide layer, a cuprous sulfide layer, a grating-type electrode, and sealing material. When sunlight passes through the transparent polyester film layer and strikes the P-N junction, it produces an electron-hole pair, and if it is connected to an electrical circuit, current is produced.

The maximum conversion efficiency of a thin-film cadmium sulfide cell in sunlight is 9.5 percent, i.e., if light with a power of 100 watts is incident on a unit cell surface area, it can achieve a power output of 9.5 watts. The maximum current obtainable per square centimeter of surface is 25 milliamps, and the maximum open-circuit voltage of a single cell is 450-500 millivolts. At present the maximum single cell area of a cadmium sulfide cell is 50 square centimeters; cells of various types can be connected in series or parallel as needed to form square arrays.

Because the cadmium sulfide solar cell is thin, light and flexible as well as resistant to radiation and ultraviolet light, some believe that it is the most promising tpye of electrical cell for future spacecraft. If it were possible to use thin-film cadmium sulfide cells as satellite power supplies, this would greatly decrease the weight of the satellites. Moreover, it could serve as a relatively ideal source in future synchronous-satellite electric power stations.

In recent years there has been universal interest in ground-based applications of cadmium sulfide solar cells. They may be used to supply electricity for aviation safety, weather observation, navigation signal recognition, communications installations, farming, highway traffic control, household applications and the like. Fig. 2 [not reproduced] shows a portable transistor radio and a reporter's photographic flash bulb powered by cadmium sulfide solar cells.

The use of a sealed cadmium sulfide solar cell to power a navigation beacon has been tested for 3 years, producing excellent results; the maximum array lifetime has already exceeded 8 years. It is estimated abroad that their lifetime may be as much as 20 years.

There are many methods of manufacturing thin-film cadmium sulfide solar cells, of which the most common are: vacuum film production, spray application, paint application, the floating glass process and vacuum evaporation. It is estimated that by 1982 the sale price of cadmium sulfide cells on international markets may be as low as 0.30 yuan per watt, close to the figure for fossil-fired power generation, and a fraction of the price for silicon batteries. At that time, cells in the 100-watt range will probably appear. It may be expected that by the 21st century cadmium sulfide solar cells will be playing an even greater role.

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LHASA'S EXCELLENT SOLAR ENERGY POTENTIAL BEING TAPPED

Beijing TAIYANG NENG [SOLAR ENERGY] in Chinese No 2, 1980 pp 23-24

[Article by Jing Zhili [2529 1807 4409]: "Lhasa, the Solar City"]

[Text] The Tibetan Plateau is the main body of the Qinghai-Tibet Plateau. It is at a high altitude, with thin air (low water vapor and dust content] of great clarity, so that the loss of sunlight passing through the atmosphere is small. In addition it is at a low latitude, so that it has long hours of abundant sunlight, making it the location with the most abundant solar radiation in the country.

Lhasa, the capital of the Tibet Autonomous Region, has an average of 3005.7 hours of sunshine a year (average for 1961-1970). The total solar radiation is 195 kcal/cm^2-year, higher than any other province or any other location at the same latitude in the country. This is why people call it the "Solar City."

The Tibetan Plateau has unique weather conditions, with the result that many kinds of equipment for utilizing solar energy have much greater efficiency there than anywhere in China proper.

In the north of our country, a triple-glazed "hot box" type of solar oven can achieve a maximum average summertime temperature of 150° C, while tests in Lhasa indicated that in the summer when the outdoor temperature was in the vicinity of 20° a double-glazed "hot-box" solar oven could achieve an average temperature of 160°.

In January of this year we made a test using a local method. We took a 25 x 15 cm piece of sheet iron painted black, attached a thermometer and let sunlight fall on it vertically. Under windless conditions (without any insulation) the maximum temperature of the sheet iron reached 70° C when the ambient temperature was about 15° C, so that the sheet iron was about 55° hotter than the surroundings. The writer has made the test many times in China proper (in the north), and both in summer and in winter, in the sunniest weather the temperature difference (the difference between the maximum temperature of the sheet iron and that of the surroundings) was no more than 30° C. This makes it clear that not only is the solar radiation in Lhasa strong, but heat losses are small in the thin, dry air.

According to data on the subject, at present a flat-plate solar water heater can be used from March to November in the South and from May to October in the North, while water heaters and water boilers can be used year-round in Lhasa; the efficiency is greater in summer than in winter. In summer the water temperature in a solar water heater can exceed 70°, while in winter it can be maintained at about 40° C.

The annual variation of solar radiation in Lhasa generally follows the change in the elevation of the sun. It is lowest in January, then gradually rises to a maximum in June, after which it gradually decreases again. Lhasa's rainy season is between June and September, but because the rain generally occurs at night, the amount of solar radiation is relatively high even in the rainy season.

Although Lhasa is extremely well supplied with solar energy, fuel is extremely scarce, and historically the masses have used large quantities of cow manure as fuel, which has resulted in the burning up of large quantities of organic fertilizer, a highly regrettable circumstance. Because of population increases in recent years, the supply of cow manure has become quite insufficient to meet the need for it, and people have begun to dig up grass roots (i.e., sod) as a fuel. But as far back as 1970 sod was included among the materials whose extraction was governed by plan, and the available supply is limited. In 1980, 8,000 tons of sod will be dug up, just sufficient to meet the needs of the masses in Lhasa. Offices, factories and military units have no recourse but to bring in firewood over distances of several hundred kilometers. According to statistics from the relevant departments, in the last 2 years about 600,000 cubic meters of wood cut in a certain forest area was shipped to Lhasa as fuel. How painful it is that the ecological balance should be disrupted in this way and that the great riches which nature has given us should be wantonly burned up!

In order to mitigate the contradiction between fuel supply and demand, Lhasa began to use solar power back in the 1960's, and by the end of 1979 the solar collector area being used by various units for washing and barbering had already reached 2,000 square meters. The Solar Power Research Laboratory of the Tibet Science and Technology Committee has developed a "solar oven" which can reach a temperature of 240° in Lhasa in January and can bake 5 pounds of cookies in an hour, as well as being usable for baking bread. The population is sparse in the plateau; one might see no trace of human habitation for a hundred li. In the past when people went on a journey or grazed livestock, they simply could not eat hot food or have not water to drink. In order to solve this problem, the Solar Energy Research Laboratory of the Tibet Scientific and Technical Committee has completed preliminary development of a portable water boiler which consists of two folded reflector plates. It is ordinarily kept folded, but is opened for use, and can easily be carried. The collector area is 1 square meter, and it can boil 10 pounds of water in an average of 40 minutes (water boils at 87° C in Lhasa). It is not only suited for the masses in agricultural villages and grazing areas but can also be carried along for field use, and it has been much welcomed by the masses. Of course, compared with the rest of the country, Lhasa's utilization of solar power is still developing rather slowly, and the masses are still paying more for such fuels as cow manure and sod than for their main foodstuffs. But we are confident that as utilization of solar energy develops rapidly in this country, with the concern of the people's government of the autonomous region and the support of the broad masses, utilization of solar energy will certainly undergo vigorous development in the population center of the Tibetan people. Lhasa, the brilliantly sunlit city on the plateau, will certainly become a truly "solar city" which makes extensive use of solar power.

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NEW MODEL VILLAGE TO MAKE EXTENSIVE USE OF SOLAR POWER

Beijing TAIYANG NENG [SOLAR ENERGY] in Chinese No 2, 1980 pp 24-25

[Article by Zhuo Ru [3820 1172]: "Utilization of Solar Energy in Daxing"]

[Excerpts] At the height of summer we drove to Daxing County, a new satellite city of the capital. Along both sides of the road the willow shade was thick and the paddy rice was flourishing in the fields; it was as if a green carpet were spread out to the horizon. The birds chirped and cicadas buzzed, enticing odors wafted from melon patches and orchards, refreshing the mind and intoxicating the senses. In about half an hour we arrived at Huangcun, where the county committee is located. This is not only a future textile city but also the location of this country's model new energy sources village.

It is no accident that our country's first new energy sources village was built in Daxing. There is a saying that "what seems commonplace is the most extraordinary and what appears easient the most toilsome." After Liberation, Daxing County's more than 400,000 working people have had a succession of rich harvests under the leadership of the Party and Chairman Mao, and their livelihood improves day by day. They completely eliminated the tragic life under the old society. Because of the continuing improvement of their standard of living, the number of baths taken has been increasing rapidly. Daxing is roughly 100 li across, but it had only one small bath house in the county seat which could hold fewer than 100 persons, and which was completely unable to meet the masses' needs. When commune members wanted to take a bath, they had to get some dried grain and make a round trip of several dozen li by bus; the fare was more than the cost of the bath, and they had to spend a day traveling. In the past, some commune members did not even bathe once a year. Young men and women who were fond of cleanliness bathed once or twice a year at the most. Workers in the country's long-distance hauling company worked amind coal, ash, sand and rock all day. After finishing work the drivers were sweaty from head to toe, the handlers were covered with coal ash, the maintenance workers were greasy, and everyone longed for a hot bath. The company's leadership made a major effort and managed to find a building, in which they installed a boiler to make a small bath house which only 4 or 5 people at a time could use; after these people had finished washing the water had become thick, with grease and coal dust floating in it. Under these circumstances, if people wanted to take a bath they generally had to stand in line.

The province's scientific and technical committee was much concerned by the situation. After repeated study, they decided to take the approach of linking the scientific and technical personnel with the masses to study ways of using solar energy to benefit the people. In order to pool their wisdom better they set up a spare time study group. They invited a number of solar energy enthusiasts from schools, communes and factories, so that the members had many abilities and skills; there were able writers, draftsmen and metalworkers. With the support of the county committee and by the use of their collective wisdom and strength, they overcame many difficulties and achieved gratifying results. Starting in 1976, they invested several years' effort and set up a series of water heaters throughout the county with a total collector area of 3,000 square meters, about a sixteenth of the total collector area for the entire country. There are rather many different collector types and models, such as tube-and-plate types, flat-box types and shallow box types; there is natural cycle heating and forced heating; there are fixed and automatic tracking types; there are large units with collector areas of as much as 130 square meters and family units with a collector area of only 1 square meter. These collectors are capable of providing baths for 15,000 people a day, and comparing them with coal-fired baths, on the average they can save more than 15 tons of coal, so that assuming 7 months' use every year throughout the province, the saving would be more than 3,000 tons of coal a year.

In the autumn of 1977, Gaomidian Brigade, Huancun Commune, with 2,300 inhabitants, set about making brick; all of the members contributed their labor, and even elementary school students came after school to move bricks and mortar. They made do with a simple approach and a employed local materials, and with the support of their brother units they built a solar bathhouse with a collector area of 100 square meters which could produce 13 tons of hot water a day at an average temperature of about 50° C, providing baths for 500 people. In this way they decreased disease, improved physical fitness and gained the praise of the masses of commune members.

In addition, the county nitrogen fertilizer plant built in 28 days a solar bathhouse with a collector area of 100 square meters, not only solving the bathing problem for staff and workers, but also using the collector as the roof of a worker and staff dormitory of more than 10 rooms, thereby solving the problem of housing for some of them. The solar heated bathhouse has produced excellent results; the temperature in April and November still reaches about 30° C, while in summer it can go higher than 70°.

After promoting widespread use of solar water heaters to solving the bathing problem for the masses, Daxing County's work in utilizing solar energy turned from serving the standard of living to serving production. For example, with the assistance of the relevant units, at the beginning of 1979 the county institute of agricultural machinery built an integrated solar unit for drying, heating water and heating a greenhouse in a brigade in Qingyundian Commune. That year, during the period of the three summer jobs they dried 200,000 jin of wheat, in their time off from labor the team members were able to take hot baths, which was both hygienic and refreshing, and in the winter they raised vegetables in the greenhouse with excellent results.

An up-and-coming unit in the utilization of solar energy, Liuminying Brigade of Changziying Commune, began to spread the use of methane in April 1980, and in only 3 months this brigade of about 130 households succeeded, through mutual assistance, in building 33 methane tanks, which enabled them to cook their food and boil water, as well as providing illumination, and even the pigpens had baths for the pigs. In addition the brigade gave financial assistance to it members to build family solar baths, and starting on 5 July 1980, in only slightly more than 2 months, 134 member households of 2 or more persons acquired solar baths. Now, when the commune members stop work and return home at noon or in the evening they can bathe or take a shower. Everyone has benefited from use of the new energy source.

Daxing County has achieved some success in "making the sun benefit mankind"; it has laid down a rather good mass basis and has won the praise and respect of the relevant leadership departments. It has decided to cooperate with the Federal Republic of Germany in building on the banks of Niantan Reservoir in the county a new model energy sources village; after the new village is built, some of the commune members will move into it and become the residents of this country's first new energy sources village.

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SOLAR ENERGY POTENTIAL OF SALT LAKES EXPLORED

Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 8, 1980 pp 12-13, 39

[Article by Wang Kangmou [3076 1660 2021] and Wei Guofeng [7164 0948 1496] of Beijing University: "Salt Lakes--Natural Solar Energy Collectors"]

[Text] A Successful Experiment

One night in December 1979, a battery of searchlights situated along the edge of a salt lake by the shore of Dead Sea in Israel suddenly shot forth an intensive light. The bluish beam of light, piercing the night sky and going over a small mountain nearby, projected itself into the pitch black distant sky. Instantly, a shout of joy like a rolling thunder shook the air.

What happened there in the quiet of the night? It was a successful and exciting salt lake power generation experiment carried out on a salt lake situated near the desert village of Ein Bokek on the shore of Dead Sea. The minister of the Israeli Ministry of Energy [& Infrastructure] directed the experiment in person and numerous scientists were also present at the site. They have attached great hope to this salt lake power generation experiment, for a success in this undertaking will signify a fundamental breakthrough in harnessing solar energy and pave the way for a bright future for solar energy utilization.

The salt lake involved in this Israeli experiment was 2.5 meters deep with a surface area of 7,000 square meters and a bottom temperature of 80 degrees Centigrade. The electric power generated was 150 kilowatts and the cost of power generation was comparable to that of hydroelectric power generation. There are many salt lakes along the shore of Dead Sea where experimental power generation can be carried out. They are planning to carry out experimental power generation of as much as 500 million kilowatts on the foundation of this successful experiment. If all the experiments should turn out successful, the total power thus generated, according to one estimate, could satisfy one-third of the electric power needs of Israel until the end of this century.

The news concerning a successful experimental salt lake power generation by Israel instantly generated tremendous interest in the United States. The U.S. Government made an arrangement with Israel to carry out a joint research effort for further development of salt lake power generation. A special scientific committee was assembled by the United States and after a careful survey they decided to build an experimental power station of 5-megawatt capacity on the Salton Sea of the Imperial Valley in southern California. The scientific committee also inspected San Francisco Bay and the Great Salt Lake of Utah. According to their estimation, the power generated by the new salt lake power generation technology will be able to satisfy 12 percent of the electric power needs of the United States, which is larger than the total electric power needs of the Third World.

New Future for the New Energy Source

Why was a successful salt lake power generation able to attract so much attention? Why does salt lake power generation constitute a fundamental breakthrough in solar energy utilization? It is because salt lake power generation does not require those expensive solar energy collectors.

Many comrades have seen an educational film entitled "Salt Lakes." Those who have seen this film have been impressed by the rich resources of salt lakes. Sodium, potassium, manganese, boron,...scores of elements in scene after scene were displayed before the viewer. However, who would have thought of the gentle, quiet green surface of the salt lake decorated with wavelets as a natural solar energy collector? This free solar energy collector can replace all those expensive different types of solar energy collectors developed painstakingly over the years by scientists and technologists at an enormous cost. This newly uncovered gigantic latent energy resource which can be utilized for the purpose of power generation has caught the attention of scientists all over the world.

As various energy resources are being rapidly depleted, the nations of the world are obliged to develop and seek new ones. Among all the new energy resources, the one which is considered to possess the greatest development potential is solar energy. Because solar energy is inexhaustible. It is also clean and does not pollute the environment. However, one of the greatest difficulties encountered in the utilization of solar energy is the high cost of solar energy collectors. For example, a plate collector manufactured in the United States costs approximately $50-$100 per square meter, while a focusing collector manufactured in Japan costs approximately 13,000-21,000 yen. The cost of developing solar energy devices in the United States in 1978 was $700 million, a major portion of which was spent on design and manufacture of the solar energy collectors. Two solar energy thermal power generating systems--the high tower focusing type and mixed focusing type--of 1-megawatt capacity designed in Japan in 1978 and tested in 1980 cost 6-7 billion yen in equipment alone and the total cost was over 10 billion yen. Scientists from all over the world have designed, constructed, or formulated many different ways of utilizing solar energy including a scheme in which solar energy power stations are to be built in outer space and the power generated is to be transmitted back to earth by means of microwave transmission. All these schemes require the use of huge solar energy collectors.

Among so many different plans and schemes, which one is the best? An interesting and inexpensive natural solar energy collector--salt lakes--has ushered in brand-new prospects in the field of solar energy utilization.

Natural Solar Energy Collector

How is power generated at salt lakes? How can salt lakes become solar energy collectors? Here lies an interesting yet quite simple scientific principle. We all know that when an ordinary fresh water lake is heated by the sun's rays the lake water temperature will rise gradually. Warm water has a lower specific gravity than cold water so it rises to the surface while the cold water sinks to the bottom of the lake. This phenomenon is commonly known as convection. After reaching the surface, the warm water evaporates into the air (see Figure 1). Therefore, an ordinary fresh water lake cannot become a solar energy collector.

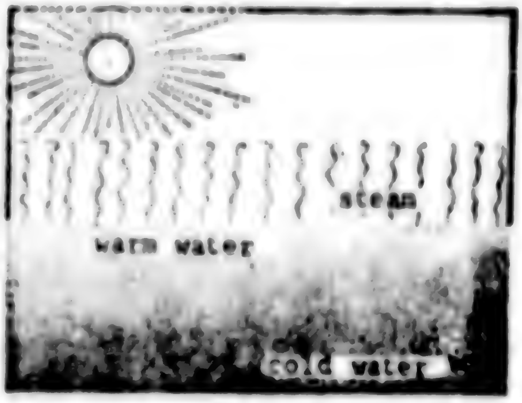

Figure 1

Salt lake water is different; its density is greater. Salt lake water is 1.2-1.4 times heavier than the weight of the same volume of fresh water. The science educational film "Salt Lakes" demonstrated to us another interesting experiment. A fresh egg sank to the bottom in the fresh water lake. It floated to the surface in the water of a salt lake. A liter of average salt lake water contains more than 50 grams of salt. When the water of a salt lake is heated by the sun's rays, a convective current will not be generated, because the lake water at the bottom contains dissolved salt and its density is high. The high density prevents the water from rising even after its temperature is raised considerably by the sun's rays which penetrate the layers of water above it to reach the bottom layer. The layer of water of relatively high density situated on top of the bottom layer acts as an insulating layer and keeps the bottom layer at the bottom (see Figure 2), preventing it from evaporating. Thus, the water temperature near the bottom of the lake will rise rapidly, reaching as high as 80 degrees Centigrade. The tranquil salt lake thus becomes a free solar energy collector of enormous size.

Strange Low Boiling Point Liquid

Ordinary steam power generation requires steam at a temperature as high as several hundred degrees; but the water temperature at the bottom of a salt lake is only 80 degrees Centigrade. How can one turn hot water of 80 degrees into steam in order to generate power? Scientists found a very able assistant--low boiling point liquid. Only those liquids whose boiling point is far below 80 degrees can be turned into steam by being heated by the hot water at the bottom of the salt lake and then used to generate power.

The hot water at the bottom of the salt lake is first drawn into an evaporator. The evaporator is surrounded by a low boiling point liquid such as freon, chloroethane, or isobutane, which plays the role of a circulating heat exchange agent. This liquid surrounds a hot water whose temperature is only 80 degrees centigrade. We know that the boiling point of freon is 24°C; chloroethane, 12.4°C; and isobutane, -11.7°C. By the heat contained in the lake water, the low boiling point liquid is turned into a high pressure vapor which is used to drive a turbine which in turn drives an AC generator. The low boiling point freon engine employed here is one of the key equipments of the salt lake power generation system. The low boiling point liquid plays an important role in the process of converting thermal energy into electric energy. The low boiling point liquid vapor, after completing a cycle, is condensed in a heat exchanger cooled by water (the relatively cold water at the surface of the lake) and returns to a liquid state. This low boiling point liquid is recycled to the evaporator to be heated again and vaporized to carry out the next cycle. In this type of power generation system, there is hardly any loss of low boiling point liquid. It is reused repeatedly. At the same time, the hot water and cold water are also returned to the respective layers of the lake (see Figure 3).

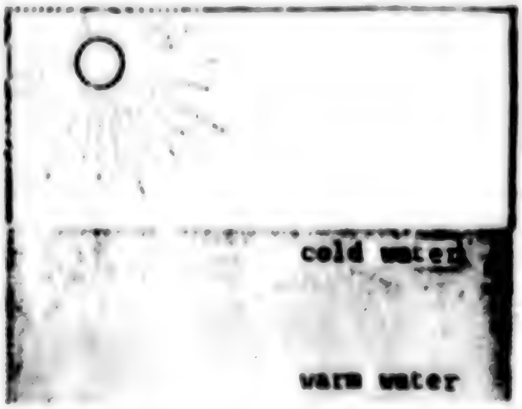

Figure 2

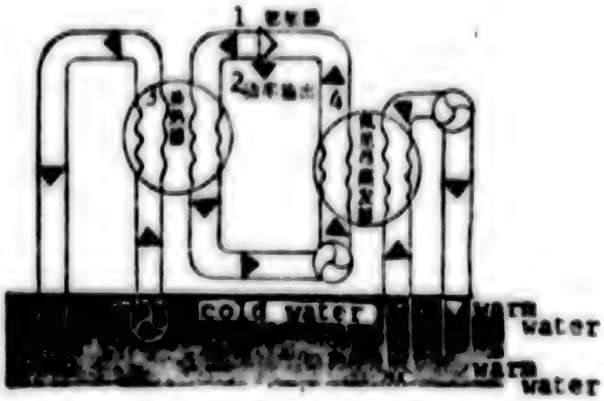

Figure 3

Key:
1. Expander (turbine)
2. Power output
3. Heat exchanger
4. Freon evaporator

Uniquely Favored Salt Lake Resources

There are many salt lakes--more than 8,000 of them in this country, a sufficiently rich resource. The vast region situated to the northwest of a line connecting the southern end of Daxingan mountain, Yinshan mountain range, the eastern end of Ala shan mountain range, Kunlun mountain range, and the Kailas mountain range contains thousands of salt lakes.

How were so many salt lakes formed? Formation of salt lakes can be tracked back to very long period of the earth's history. The region where there are many salt lakes today used to be an ocean. As a result of the motion of the earth's crust, the crust was compressed and many mountains were shaped. This activity forced the ocean to retreat. During the course of the rise and fall of the earth's crustal movement, a basin was gradually formed, namely, a depression which was surrounded by high mountains. This type of closed or semiclosed water-collecting basin is the terrain formation most likely to become a continental salt lake. The water-collecting basin was supplied with water over a period of 7 million years. The water, either flowing on the surface or underground, was eventually collected in the basin. On its way to its destination, the natural water dissolved everything soluble including cations of metals such as sodium, chlorine, and magnesium and also anions of acid radicals and carried them all to the basin and into the lake.

In the early stage of the evolution of a salt lake, it was no more than a fresh water lake containing only a small concentration of salt. Exposed to cold and dry climatic conditions, large quantities of water evaporated, while salt continued to be carried into the lake. As a result, the salt concentration of the lake water increased steadily. The process was repeated over the years and a fresh water lake containing only a small amount of salt in the beginning gradually became a salt lake.

This country is blessed not only with an abundance of salt lakes but also with plentiful sunlight in the regions where the salt lakes are. However, its distr'bution is not so uniform thanks to the limitations imposed by climate and latitude. These areas may be classified into five classes. The first through the third class areas include such areas as Qinghai, Xinjiang, Gansu, Ningxia, and Yunnan where there are 2,200-3,300 hours of sunlight a year. The fourth and fifth class areas include such areas as Hunan, Hubei, Guangxi, Sichuan, and Guizhou where there are 1,000-2,200 hours of sunlight a year.

The first through third class areas are the areas where solar energy resources are abundant. The total area is very large, occupying more than two-thirds of the land area of this country. Although the fourth and fifth class areas have only limited solar energy resources because of too many rainy and cloudy days, salt lake power generation is still feasible. It is evident from the salt lake power generation experiments carried out abroad that the technology involved in this undertaking is not complicated at all. The technological capability of this nation today can completely realize this technology. When a salt lake having a large surface area is to be used in an experiment, it is advisable to consider covering the surface with a mesh made of plastics in order to prevent surface waves from being stirred up, because surface waves can break up the interface between the cold and hot water layers and thus lower the efficiency. We sincerely hope that these unique salt lakes having a large surface area which lie quietly in the bosom of our homeland today will soon be able to manifest its extraordinary effect as a natural solar energy collector and produce a huge quantity of inexpensive electric energy in service of this fatherland for its "four modernizations."

9113
CSO: 4006

NEW SOLAR COLLECTOR DEVELOPED IN LIAONING

Beijing GUANGMING RIBAO in Chinese 1 Oct 80 p 1

[Article by reporter Sun Jun [1327 6874]: "New Solar Energy Collector Successfully Developed in Liaoning"]

[Text] A new solar energy collector--Model SZ-1 glass vacuum tube solar energy collector--has been successfully developed by the joint effort of the Shenyang Construction Research Institute, the Shenyang Glass Instrument No 2 Plant, the Liaoning Provincial Construction Design Institute, and the Dongbei Construction Design Institute.

This glass vacuum tube solar energy collector is a high temperature, high efficiency collector. It can raise the water temperature to as high as 100 °C, and is insensitive to environmental conditions such as air temperature, wind velocity, and operating temperature. It performs well under conditions of scattered light, radiated light, and light at low incidence angle. It can function normally all year round in very hot areas as well as in very cold areas. In addition to these, it is light in weight, simple in construction with convenient technology, has a long, useful life, saves in metal, is made of readily available materials and is suitable for mass production and general application.

The collector can be used as a hot water heater to supply hot water for households, offices, and businesses. It can also be used as the heat collecting element of such devices as space heating, air conditioning, electric power generation, refrigeration, and drying. The collector is very well received by the masses and has been used to heat hot water for the bathhouse of the Liaoning Provincial Science Commission, saving a large quantity of coal and electricity.

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CSO: 4006

ACCELERATING THE USE OF SOLAR ENERGY IN BEIJING ADVOCATED

Beijing BEIJING RIBAO in Chinese 9 Jul 80 p 1

[Article by Yang Yinxin [2799 0603 2450]: "Accelerating the Use of Solar Energy"]

[Text] Beijing is situated at 40 degrees north latitude. It has an area of 16,800 square kilometers and, on the average, 2,700 hours of sunshine each year. The amount of solar energy received is equivalent to 180,000 units of electric energy each year and to the energy contained in 2.1 billion tons of coal. We must employ various technical means and put this enormous amount of energy to good use. We must make it play an important role and contribute to the construction work related to the modernization of the capital.

Under the leadership of and supported by the various concerned departments of the State Council, the research work related to the utilization of solar energy in Beijing and its popularization have made some definite progress since 1975. According to an incomplete statistics, there are already more than 360 units in the municipality who have installed solar energy hot water heaters, wtih nearly 40,000 square meters of light collecting area. The temperature of hot water obtainable from these hot water heaters is approximately 50 degrees celsius, and a temperature as high as 65 degrees or more can be attained by some. On the average, 1 square meter of light collecting area can provide 100 jin of hot water a day, sufficient to bathe 3-5 persons. These hot water heaters can be operated 7 months (April through October) a year and 4 tons or so of coal can be saved from use of every 10 square meters of collector. Therefore, citywide, 16,000 tons of coal can be saved annually. Research work related to other applications of solar energy, such as ice making, maintenance of cement structures, and construction of solar energy cells, is also being done and some definite results have been achieved. But there are still many more problems that are urgently in need of a solution.

The fund needed for its development must be assured. The solar energy utilization devices used today are still quite primitive so that it will take a while before these devices may be produced on a regular basis. In the meantime, sufficient funds must be provided to aid its development. We suggest that the concerned goverment department sets aside a special fund earmarked for the development of the solar energy utilization.

Research work related to an engineering project to demonstrate the solar energy devices, together with its design and construction work, should be pushed aggressively. From the viewpoint of development, applications of solar energy to space heating, air conditioning, and residential hot water heating have a promising future. In order to expect growth in this area of solar energy utilization, demonstrative engineering projects must be done well. The key factors must be grasped through these exercises and then managed well.

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CSO: 4006

TREND IS TOWARD SMALL-SCALE FAMILY-TYPE SOLAR HEATERS

Beijing BEIJING RIBAO in Chinese 20 Jul 80 p 1

[Article by Fan Jinqi [5400 6651 6386]: "Daxing County Makes Progress in Diversified Uses of Solar Energy; Bathing, Cooking, Drying, Lighting, Space Heating, and Cultivating Vegetables"]

[Text] In developing various businesses related to the solar energy utilization, Daxing County put emphasis on the diversified uses of solar energy and made significant progress.

Since work related to solar energy utilization was launched in April, 1976, more than 70 baths heated by solar energy have been built in this county, with a total light collecting area of [illegible]400 square meters. They provide hot baths to more than 13,000 persons a day and save more than 20 tons of coal a day. At the same time, they put emphasis on developing diversified uses of solar energy. The No 3 Brigade of Qingyundian No 2 Village has developed a solar energy device which is not only capable of providing hot water but also can be used to dry wheat during the "three summers" period and to grow vegetables during winter and spring. This county went one step further and developed a combined utilization of solar energy and methane gas. The used warm bath water discharged from the solar energy baths was conducted to the methane gas generating tank in order to raise its temperature and to increase the methane gas yield.

The county science commission is presently helping the Yufa Brigade of Yufa Commune in its construction of a combined solar energy and methane gas bath with 150 square meters of light collector. When it is completed, it is expected to provide enough bath water for more than 100 persons every day, and methane gas for illumination and cooking purposes. During winter and spring, this device will provide heat to grow vegetabels in the greenhouse.

The solar energy baths of this county used to be centralized units of large to medium scale. Today, small scale family type solar energy hot water heating units are gaining popularity. This type of hot water heater was designed according to the principle of box type solar energy oven and the tube plate type hot water heater. It is a box type hot water heater with relatively simple construction and can be easily installed. It is small in size and light in weight. It can be used in a flat or a house with two or more stories. It is suitable for household installation. There are already some 40 families who have installed this type of small box type solar energy hot water heaters. By connecting several of these small hot water heaters in series, the unit can then be used for the collective bath as well. Today, a special factory has been set aside in the Daxing County Lighting Fixture Plant for the manufacture of these small, box type solar energy hot water heaters for public consumption.

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QINGHUA UNIVERSITY MAKES NEW STRIDES IN SOLAR ENERGY RESEARCH

Beijing BEIJING RIBAO in Chinese 26 Sep 80 p 1

[Article by Liu Jingshao [0491 0079 6856]: "Solar Energy Research in This Country Makes New Progress; Qinghua University and Other Units Successfully Develop a High Efficiency Solar Energy Collector"]

[Text] An all-glass vacuum solar energy collector and a glass vacuum tube solar energy collecting device were successfully developed and manufactured by a number of research units including Qinghua University and passed authentication on 25 September. These new types of solar energy collectors--which have reached advanced domestic standards and approach international standards of similar products--constitute new progress made in this country in research work related to solar energy utilization.

One of the key factors related to the successful utilization of solar energy is the high efficiency thermal energy collector and associated devices. The all-glass vacuum thermal energy collector and the glass vacuum tube thermal energy collector which passed authentication recently are brand-new types of solar energy collecting devices. The daily, monthly, and annual average energy collecting efficiencies of these devices are higher than the conventional plate type collectors. They maintain high energy collecting performances even on a windy, winter day or under conditions of low incident angle or a diffused and scattered light. In addition to heating the hot water for household use, these devices can be used to heat hot water for industrial application. These devices can be further applied to other areas such as refrigeration, air conditioning, desalination of sea water, and low temperature electric power generation.

Development of the all-glass vacuum thermal energy collector was undertaken by Qinghua University. Research work began in March last year and was carried out by the Department of Radio and Electronics with the cooperation of the Department of Thermal Energy Engineering. Preliminary success was achieved in September of the same year and the device was on exhibit during the Second National Solar Energy Conference. Later, the performance of the vacuum thermal energy collector was further improved with the aid of the Beijing Glass Instrument Plant, so that its efficiency could be raised to advanced domestic standards.

Development of the glass vacuum tube thermal energy collector was undertaken jointly by Qinghua University, the Beijing Electron Tube Plant, and the Beijing Glass Instrument Plant. This device has superior thermal energy collecting capabilities. Its structural design is quite rational, so that the collector can be easily assembled and disassembled. The Beijing Solar Energy Institute undertook the testing of these thermal energy collectors and, as a result, a relatively complete set of thermal performance data was compiled for the first time in this country.

The authentication of these devices was sponsored jointly by the Beijing Municipal Science Commission and the Science Committee of the Ministry of Electric Power. Altogether, 60 persons, including the experts, cadres, and technical personnel representing nearly 30 units from such areas as Beijing, Tianjin, Donghei, Zhongnan, Huadong, Xinan, and Huabei, attended the authentication.

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CSO: 4006

SOLAR ENERGY IN GANSU TO SAVE SIGNIFICANT AMOUNT OF FIREWOOD

Beijing RENMIN RIBAO in Chinese 6 Aug 80 p 1

[Article: "Thirty-two Counties in Gansu Push Use of Solar Energy"]

[Text] Since the end of July, 32 counties in Gansu have pushed use of a number of solar ovens and solar energy hot water heaters. These solar energy devices will be put into service within this year.

Gansu is situated between 32 and 42 degrees north latitude. The greater majority of the areas enjoy, on average, more than 2,500 hours of sunshine annually, and as long as 3,000 hours along the Hexi corridor. Taking advantage of this superior natural condition, work related to the utilization of solar energy has been pushed forward steadily and aggressively in recent years from a stage of trial construction, trial production, trial application and demonstration. By the end of June, six specialty plants and factories for the manufacture of solar energy hot water heaters and solar energy ovens have been built all over the province. They have so far constructed 4,860 square meters of solar energy hot water heaters and 1,987 units of solar energy ovens. According to what has been shown by the demonstration station, every square meter of solar energy hot water heater will be able to save 300-400 jin of coal a year under the normal conditions, while a focusing type solar energy oven will be able to save up to 2,000 jin of wood and grass a year. For example, since the solar energy oven was popularized in Shangzhai Brigade of Sunlin Commune in Lintan County the 280 families there say they can save approximately 500,000 jin of wood and grass a year and also 3,700 workdays which otherwise will be spent on gathering wood.

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CSO: 4006

SOLAR ENERGY FINDS PRACTICAL APPLICATION IN SUBURBAN BEIJING

OW290818 Beijing XINHUA in English 0804 GMT 29 Aug 80

[Text] Beijing, August 29 (XINHUA)--The use of solar energy is gaining wide popularity in a county on the outskirts of Beijing, particularly for heating public baths.

According to the Scientific and Technological Committee of Daxing County, where a satellite city is being built, more than 80 county government offices, factories and rural production units are heating public baths by solar energy, and several hundred peasant households have been equipped with solar heating devices. An estimated 5,700 square meters of installations are absorbing sunlight.

The county is pioneering the use of solar energy at the initiative of the county Scientific and Technological Committee in order to use this cheap source of energy to increase the benefits of the people.

There are some 2,700 hours of sunshine a year in the Beijing area, and the sun can heat water to 40 to 70 degrees centigrade during the warmer months between April and October.

Daxing County's nitrogen fertilizer plant has installed a hot water heater with a 100-square-meter light-absorbing panel. This not only saves coal, but also increases workers' benefits. They can bathe after work everyday.

For local peasants, a hot bath used to be a rare treat. But now that rural communes and individual households are installing solar water heaters, bathing is a daily routine.

Peasants use a small heater with a sunlight-absorbing panel one to a few meters square. In the Liuminying production brigade, 115 of the 160 households have such devices. A one-meter panel heater can supply a hot water bath for two or three persons.

One production brigade is using solar energy to dry grain and raise the temperature of greenhouses. Some production brigades inject solar-heated water into methane gas ponds to boost gas output.

The county has a sparetime solar energy research group which provides technical guidance to the peasants. Some county factories produce and install the heating devices.

CSO: 4020

RURAL JIANGSU COUPLE PRAISE BENEFITS OF SOLAR POWER

OW140255 Beijing XINHUA in English 0236 GMT 14 Nov 80

[Text] Nanjing, November 14 (XINHUA)--Wu Ying and her husband have saved 400 kilograms of firewood this year since they began to use a sun-powered stove.

This peasant couple from the Yenkou commune in Hai'an County, Jiangsu Province, are beneficiaries of a solar stove with a three-square-meter sunlight-absorbing panel which is coming into wide use in the area.

The stove can boil 2,000 milliliters of water within one hour. "Besides boiling water, I use it to prepare porridge, stew pork and boil pig feed," said Wu Ying, a housewife of a family of seven.

A stove costs about 50 yuan to produce, and can save 450 kilograms of coal or 1,300 kilograms of firewood each year, even though the area has only about 150 sunny days a year.

"The solar stove not only has freed us from the plight of collecting firewood, but also helped my family increase its income," Wu Ying said.

In her production team, 28 of the 36 peasant households are now using solar stoves. By the end of the year, the number of peasant households county wide using such stoves is expected to increase to over 1,000.

Solar energy is being utilized in many rural areas in China, as are other alternative energies, including bio-gas and wind power. Some rural areas operate small coal mines or small hydroelectric power stations.

Hai'an County has achieved remarkable successes in solar energy research and use. It has manufactured over 200 kinds of solar devices, including stoves, water heaters, seed breeders, bath houses, greenhouses and air conditioners.

CSO: 4020

'GUANGMING RIBAO' COMMENTS ON ENERGY CONSERVATION

HK230735 Beijing GUANGMING RIBAO in Chinese 10 Aug 80 p 1

[Article by XINHUA commentator: "Energy Conservation is an Important Policy Decision for Achieving the Four Modernizations"]

[Excerpts] This year is the second year of readjusting our country's national economy. How should we take the road of the four modernizations after readjusting our country's national economy? This is a major problem which concerns the people of the whole country. When the long term plans were formulated in the first half of this year, many comrades held that after readjustment, it was necessary to concentrate financial and material resources on energy capital construction and promoting coal and hydroelectric power production. However, greatly promoting energy capital construction projects needs not only a large amount of capital but also a considerable amount of time. On the whole, new productive capacity that is built can only be used after 6 to 7 years. The rate of increase in energy resources which our country has newly exploited is very small. If we rely mainly on exploiting energy resources, the aid is too slow in coming to be of any help.

Leading comrades of the Party Central Committee and the State Council recently pointed out that over the long term, if our country wants to solve the problem of energy resources, we must attach importance to both exploitation and conservation of energy and give priority to conservation of energy now.

Compared with the exploitation of energy resources, conservation of energy resources is economical. The utilization efficiency of energy resources exploited in our country is very low, waste is terrifying and the potential for energy conservation is even greater. The average consumption of standard coal for the value of output for each 10,000 yuan in our country in 1979 was 11 metric tons. However, in Shanghai Municipality it was only 3.7 metric tons. It is expected that the consumption of energy resources throughout the country will reach the level of Shanghai in the future. Even it is twice as much as that in Shanghai, we can use the same amount of energy resources as we are now using to double the industrial output of the whole country.

Where do we waste our thermal energy? According to the analysis by circles concerned, about 35 percent is wasted in improper enterprise management and 65 percent in backward equipment and technology and the huge energy consumption by the economic structure. Therefore, we have three ways to conserve energy resources: 1) improve enterprise management; 2) renew and transform equipment and production technological process; 3) transform the economic structure.

Over the past 2 years, with our shortage of energy resources, our country has been able to maintain a fairly high rate of development of industrial production because it has raised the level of enterprise management and reduced the consumption of energy resources. In the future, we must continue to mobilize the masses to establish and put on a sound basis the system of energy conservation, further improve management and conserve energy resources. In addition, we must also achieve better results in the other two areas.

We have many factories, such as chemical fertilizer plants, aluminum plants and so on which are all well known for their high coal and electricity consumption. These factories have backward equipment, low production efficiency and huge energy consumption. Thermal energy which is often utilized only once and then discharged as waste liquid or exhaust gas. To conserve energy, it is therefore necessary to transform equipment, reform the production technological process and utilize energy resources more than once to raise the utilization rate of thermal energy and save fuel.

Of course, we must spend money and time to transform equipment and technology. However, compared with carrying out capital construction and exploiting energy resources, we spend much less money to do this and we can score much faster results.

Some comrades are looking into what our production level should be if the people's living of our country reaches the level of "being comparatively well-off," that is, an income of US $1,000 per capita, by the end of this century. When many developed countries reach this living standard, an average of half a metric ton of steel is produced for each person. If we take the same road, we will need 600 million metric tons of steel. What a large amount of mineral resources, coal and electricity we will need! We cannot afford to take this road. Since our country is poor and has a large population, we must take our own road in developing the economic structure and put more emphasis on light-duty economic structure which consumes fewer energy resources, uses less capital and equipment, scores achievements faster and employs more people. According to calculations, to produce an output value of 100 million yuan, light industry consumes 80 percent fewer energy resources than heavy industry. Since we made some readjustments in the proportion of light industry to heavy industry in the first half of this year, our use of standard coal dropped by some 10 million metric tons. In industry, we must put more emphasis on light industry, particularly "labor-intensive" industry. In agriculture, we must promote more diversification. We can thus conserve energy resources, save capital and other resources, create more wealth and increase the chances for employment. Therefore, if we transform our economic structure with energy conservation as the central task, we can acquire several advantages.

Transforming technology and the economic structure with energy conservation as the central task is actually the transformation of our country's industrial technology and a transformation which turns the backward features of our country's industry to modernized ones.

CSO: 4006

LONG-TERM PLANNING FOR EXPLOITATION OF TIDAL FORCES URGED

Beijing HAIYANG [OCEANS] in Chinese No 11, 15 Nov 80 pp 1-2

[Article: "Development and Utilization of China's Ocean Energy Resources"]

[Excerpt] Our great motherland's maritime area is vast, comprising 4.7 million square kilometers and with a coastline over 18,000 kilometers long. There is more than 14,000 kilometers of island coastline, and the ocean energy resources are very rich.

China's continental shelf is very wide, and the benthic oil and gas deposits are very rich. The East China Sea and the South China Sea are among the world's most promising benthic oil fields. China has already built its first ocean oil field--the Dagang Oil field, and high yielding oil wells have also been drilled in the South Sea.

Our nation's coastline is long, with numerous harbors. The ocean area inside bays totals over 20,000 square kilometers, and the energy resources of the tides are rich. If they were fully utilized, they could generate up to 300 billion kilowatt hours a year. The Yellow Sea alone has a tidal energy of 55 million kilowatts. China's tidal energy is mainly distributed in Zhejiang and Fujian. The tidal differential on the Qiantang River is 8.9 meters, one of the biggest in the world and suitable for building large tidal power stations. In addition, Sanmenwan in Zhejiang and Jiaozhouwan in Shandong are also suitable for building power stations.

Our nation built its first tidal turbine-pump station in 1955. In 1957, the first tidal power station was built in Shandong. Shunde County in Guangdong built a low water head flow-through tidal turbine power station, resolving the electrical power problem for most of the county, shortening navigation routes, and reducing waterlogging over 300,000 mu of farmland. This year, our nation's first bidirectional tidal power station--Jiangxia Tidal Power Station--is being constructed without delay and the No 1 generator has already been installed and is functioning normally. The Jiangxia Power Station has a total of 6 generators. Each unit has a capacity of 500 kilowatts. We should analyze the specific situation of each locality to build appropriately sized tidal power stations and to fully develop tidal energy.

The East China Sea and the Yellow Sea are relatively warm, and the South China Sea is even warmer. In the north, the average water temperature is 25 to 27° C, and it is above 28° C in the south. There is tremendous potential for power generation using temperature differentials.

Our nation's work in extracting uranium from seawater is being carried out actively by many units and real strides have been made. Some methods of uranium extraction have progressed quickly, and a certain expertise has been achieved.

The development and utilization of ocean energy resources in our nation (the world's advanced levels) still lags far behind. Although at present many knotty technical problems still exist, and we are still in the research stage, inasmuch as the energy resources of the ocean are very rich and the potential is tremendous, in the long run this will be a great source of energy for China. In the next century, we may achieve large-scale development and utilization. Therefore, from now on we should emphasize this, strengthening basic research and accelerating the pace of oceanic surveys. Projects which are already underway should be speeded up to achieve results sooner. Projects not yet begun but which have long-term significance should be the object of comprehensive planning, and research should begin as soon as possible. For the present, we should strengthen the forces in ocean work, establish specialized or coordinated agencies for ocean energy resources, and a long-term plan should be drawn up to facilitate the overall utilization and development of China's ocean energy resources.

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